# TELEPHONE ENGINEER

Vol. VII CHICAGO, JANUARY, 1912 No. 1

## ONE HUNDRED DOLLARS
### IN CASH PRIZES

¶ In an effort to bring to the public mind a realization of the simplicity and certainty of long distance telephoning, and to overcome the feeling of dread with which most people undertake a long distance conversation, **Telephone Engineer** offers to its readers a series of four cash prizes for the four best short articles or essays on that subject. For a full understanding of the condition which it is aimed to correct, read the editorial in this number. The conditions governing the contest follow. The cash prizes are:

| | | | |
|---|---|---|---|
| **First Prize,** | **$50.00** | **Third Prize,** | **$15.00** |
| **Second Prize,** | **25.00** | **Fourth Prize,** | **10.00** |

¶ Articles shall not exceed 2,400 words in length, and may be as short as desired.

¶ Manuscripts should be typewritten, double-spaced, and sent folded, not rolled.

¶ All manuscripts or inquiries should be addressed to "Contest Editor, Telephone Engineer, Monadnock Building, Chicago, Ill."

¶ Receipt of manuscripts cannot be acknowledged, nor will unavailable articles be returned.

¶ The contest will be closed July 1, 1912, and prize winners will be announced in the August number of **Telephone Engineer;** the prize winning articles will be printed as soon thereafter as possible.

¶ Articles will be read and prizes awarded by a board of judges, whose personnel will be announced in **Telephone Engineer.**

¶ **Telephone Engineer** reserves the right to buy, at its regular space rates, such articles as are deemed desirable, although not prize winners.

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# Telephone Engineer

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CHICAGO, JANUARY, 1912.


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## *OUR SECOND PRIZE CONTEST.*

ALMOST three years ago, TELEPHONE ENGINEER, then only a few months old, created a ripple of excitement on the placid current of trade journalism by offering a series of cash prizes for essays on a subject vital to the progress of telephony. The subject was "Telephone Courtesy," and the object was to correct, as far as possible, the manifest tendency of the telephone-using public to speak in an uncivil and discourteous manner. This condition was so serious as to constitute almost an emergency, and telephone men everywhere welcomed the effort to right it. The prizes offered drew out some excellent literary talent and a few real gems of thought and expression, which were published in bold type in TELEPHONE ENGINEER. To show how strong was the need for such effort, we may state that these essays have been reproduced, in whole or part, in literal hundreds of newspapers, magazines and telephone directories, and the direct result has been an extraordinary increase in politeness and the use of civil forms among telephone users.

But there is another condition still demanding correction, which is even more practically vital than the matters of courtesy, for it affects the efficiency of expensive plants and the development of the telephone industry. We refer to the *dread* of long distance.

Those five last words constituted the title of an editorial in TELEPHONE ENGINEER last January. And since that editorial embodied all our thoughts on the subject, and forms the basis for the new contest which we are about to announce, we reproduce it here:

"A slave to the telephone" is what the editor of a New York paper called E. H. Harriman. For the late railroad magnate was one of the comparatively few, even in the telephone age, who appreciate to the full extent the commercial value of that institution. He was never out of reach of an instrument, whether in his bath, at his beside, or on his dining table. Even when he went into the wilderness the telephone must be there. "A slave to the telephone." And when he heard that, he said, "Nonsense! The telephone is a slave to me!"

No doubt when Mr. Harriman had occasion to talk to Chicago from his New York office he took up his receiver and talked with the same aplomb as when he used an inter-communicating set. And, no doubt, in this he gained an advantage over his auditor at the other end of the line, who probably was less at ease and consequently less inclined to aggression.

For it is not yet given to most men to participate in a long distance telephone conversation with any degree of *sang froid*. Whether it is a dread of the unfamiliar, a fear of unsatisfactory results, or an awe of another city, the fact is that the average man shrinks from receiving, and dreads to originate, a long distance call.

We have no intention of pondering the psychology of this phenomenon, although doubtless it is very simple. But we do insist that it should receive profound consideration by telephone engineers. There used to be people who dreaded riding on railroads, and the attitude of most women toward telegrams is still a subject of comment. The railroads have cured the prejudice by making their service attractive. In some other

countries the telegram lacks its sinister significance because its use has been made absurdly easy and convenient, so that it is as common as the picture postcard. In Mexico, for example, one buys a card for five cents, writes a message, and drops it in a box; whence it is collected and transmitted by wire, to be delivered a few minutes later transcribed on a similar card. The Mexican women do not dread the telegram.

Yet the telephone companies have striven expressly to make long distance telephoning as attractive as possible. Their engineers have devoted years to perfecting voice transmission over long lines. Their operators are trained to give all possible assistance at both ends of the connection and to bear all the burden of finding and capturing the called party. All the originator of the call has to do is name his desires. As this apparently ideal arrangement has not served to remove the dread, something more is evidently necessary.

Of course, the present long distance telephone traffic of the country is really tremendous. But this is a tremendous country, and its telephone possibilities are so far ahead of its actualities as to make the latter seem poor indeed. And they will be poor as long as the average man dreads the long distance call. That the dread really exists needs little observation to confirm.

What the cure for this condition is we will not pretend to suggest at this time. Perhaps some of our readers have ideas on the subject. If so, we would be glad to hear from them.

Since that editorial originally appeared we have been asked over and over again to suggest a remedy for the ill—as though mere diagnosis betokened curative ability. For toll business is profitable, and existing toll lines could carry a great deal more traffic than they do.

But the dread is there, in the public mind, whether the line be a thousand or only fifty miles long; whether the originating instrument be manual, semi-automatic or full automatic. In fact, as soon as the word "toll" appears in the directory the public shrinks from its telephone.

So that is the question before the telephone body. How can we make long distance more familiar, natural and attractive to the public? What means can we use to convince the laity of the ease of long distance?

Telephone Engineer offers a series of cash prizes for the four best solutions of the problem. The first prize is $50, the second is $25, the third $15 and the fourth $10. The contributions to the contest should take the form of essays not over 2,400 words in length, and as much shorter than that as may be desired. They should be of such a nature that they may be presented direct to the public, for it is the public whom we must interest; although articles containing suggestions for telephone managers will not be barred and may win a prize.

A display announcement giving all conditions of the contest appears on another page. Please observe the rules as to typewriting, folding and addressing manuscripts. The contest closes July 1, 1912, by which date all essays must be mailed to this office to be eligible. The winners will be decided by a board of judges, whose personnel will be announced at that time, and the prize-winning essays will be published in Telephone Engineer as soon thereafter as possible. And to be prize winners they will have to be of practical value—not merely dissertations on the conditions as they exist, nor catalogues of the already known and advertised advantages of long-distance telephony. Remember, we have got to make the public *feel* that long-distance telephoning is the simplest, easiest and cheapest thing in the world.

There are no restrictions or conditions other than those named. Every reader of Telephone Engineer is eligible as a contestant. Get busy!

## *MUTUAL COMPANIES.*

IN another editorial we make the statement that compulsory physical connection will place mutual organizations and public utilities on the same footing under the jurisdiction of the Interstate Commerce Commission. The Ohio Public Service Commission, however, has not seen the matter in the same light. Some time ago the Kilbourne Mutual Telephone Company, operating in Delaware county, Ohio, sought to have the commission compel the telephone systems of the Galena and Sunbury Telephone Company, the Ashland Telephone Company and the Citizens' Telephone Company of Delaware to connect with its line.

December 8th the Ohio commission reached the conclusion that it has no jurisdiction over mutual companies. It is suggested that if these small mutual systems desire the benefit of connection with public utility companies, they should reorganize on such a basis as will bring them into the same class.

It is evident that the mutual system is out of date. It has served its very excellent purpose, which was largely an emergency one, and has had its day. More, it has done wonders for the development of the universal telephone, and has established successful lines where no profit-seeking corporation would be tempted to venture.

But the attitude of the operating company toward the country districts has changed. Today the farmer is not confined to a choice between building his own line or doing without a telephone. He is recognized as a valuable addition to any operating company's list of subscribers.

Many of these mutual systems are well built and have value. They would be more valuable, however, as integral parts of the nearest accredited telephone plants, and would then enjoy all the privileges of interconnection and commission protection. At present they form only ragged fringes on the outskirts of telephone civilization. Under decisions like that of the Ohio commission, they must be either cut off or woven into the fabric of public utility.

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## *DEVELOPMENTS OF 1911.*

WHEN a publication crosses the dividing line between two years its editors are always tempted to venture bold predictions for the new twelve-month, or to praise the accomplishments of the old. We have modestly chosen the latter course, because it is much easier and usually more accurate. But we realize, on looking over volumes V and VI of Telephone Engineer, that a résumé of the developments of 1911 would, after all, prove little more than an abstract of what has appeared in these pages during that period. So we shall confine this recapitulation to a few brief comments on the more salient features of recent telephone history.

Railway telephony has made big strides since 1910. It has shown no startling development, perhaps, but the growth has been healthy and the permanency of the new system has become established.

Interesting from a scientific viewpoint at least was the development of a multiplex telephone system by Major Squier and others. While this system shows no evidence of practical application as yet, it has many possibilities and offers great opportunity for further experiment.

The endorsement of compulsory physical connection of all telephone lines by the National Independent Telephone Association worked an epoch in the progress of the art of serving the public. In this connection we may comment on the year's changes in the attitude of public utilities toward the public, and the increasing interest in public relations. Further along this same line is the now established principle of commission control.

Long-distance telephony in this country and submarine cable telephony abroad have made some remarkable strides, which have made possible the promises of engineers for still more remarkable developments to come.

Politically, not much change has taken place in the Bell-Independent relationship, although there seems to be a tending toward replacing sentiment by reason, and negotiations of one kind or another are almost continuous.

Increasing interest in full and semi-automatic systems is manifest, both here and abroad, and the manufacturers of manual apparatus are generally experimenting with equipment of this order.

Altogether the developments of the year have been sane and satisfactory without any particularly extraordinary events. Abroad, the taking over of Great Britain's system by the postoffice is regarded as a favorable omen by the friends of government ownership, while advocates of the corporation-owned utility see in it a retrograde step. The telephony of Constantinople shows that the telephone is gradually breaking down the barriers of the Far East, and that, after all, there is still much to do before the world reaches its saturation point. Indeed, one of the healthiest indications of continued activity in telephone manufacturing is the increasing interest of American manufacturers in the foreign market.

## *INTERSTATE COMMISSION'S JURISDICTION.*

BY this time the Interstate Commerce Commission is supposed to have in its hands some thirty thousand reports from the telephone companies of the United States. The Division of Statistics, under date of November 15, sent out approximately that number of blanks, to be filled in and returned by December 15. Fourteen questions were asked, as follows:

1. Give the exact name in full of the corporation, association, partnership or person in whose behalf this report is made.
2. Give the address of the respondent.
3. State the nature of the organization, whether a corporation, association, partnership, or natural person.
4. Is the respondent a "mutual" company operated exclusively for the convenience of patrons and not for profit?
5. (a) Can the respondent with its own line or lines enable a person in one state, territory or district of the United States to talk directly with a person in another state, territory or district of the United States, or in a foreign country?

(b) Can the respondent by physical connections with the lines of other companies enable a person in one state, territory or district of the United States to talk directly with a person in another state, territory or district of the United States, or in a foreign country?

6. If the answer to either section of question 5 is in the affirmative, state whether or not the respondent is actually engaged in interstate commerce, as defined in the Conference Ruling hereinbefore quoted.
7. Give the name and address of the officer to whom correspondence relative to the returns in this form should be directed.
8. State the amount of fixed capital devoted to telephone operations on December 31, 1910. (See definition of "Fixed Capital" in section 12, page 23, of Accounting Series Circular No. 30.)
9. State the number of shares of capital stock issued and outstanding on December 31, 1910, and the par value per share. If there were two or more classes of stock, give particulars for each.
10. State the amount of funded debt issued or assumed and outstanding on December 31, 1910.
11. State the gross operating revenues for the year ended December 31, 1910.
12. State the gross operating expenses for the year ended December 31, 1910.
13. State the number of exchanges (excluding private branch) operated on December 31, 1910.
14. State the number of subscriber's station on December 31, 1910.

Answers to the first seven questions were compulsory; but the last seven depend upon the status of the company, and those not coming under the jurisdiction of the commission were not required to answer them.

The detailed information divulged by these forms will not, of course, be made public by the commission. But it will be known how many of the approximated thirty thousand companies are public service corporations and how many are mutual organizations. The last census report showed about 5,600 corporations out of some 23,000 systems. In that ratio, the present number of public telephone utilities in the United States is approximately 7,300, with some 22,700 mutual and farmers' line systems. This, if substantiated by the commission returns, would indicate a growth of almost thirty per cent in four years. These figures correspond satisfactorily with those of TELEPHONE ENGINEER's lists.

The ruling of the commission of March 13, 1911, a copy of which accompanied the questions, does not distinguish mutual organizations from public utilities. The only rule gven for determining the status of any telephone system is its arrangements for handling interstate business. Question 5 (b) reveals that under universal physical connection all operating telephone systems would come under the jurisdiction of the commission. Compulsory physical connection is coming, in spite of the Bell companies' aversion to it; and with the tariff schedules of some thirty thousand companies to examine and pass upon, the commission may look for considerable business ahead.

## *TELEPHONE LINE MATERIALS.*

THIS issue contains the second installment of the report on copper-clad steel wire for telephone service, prepared by a private expert of undoubted ability. A considerable portion of the report is devoted to the determination of the apparent resistance and the apparent inductance of copper-clad wires with alternating currents of telephonic frequencies. The determination of resistance and inductance to continuous currents is relatively simple, but with alternating currents there are complications, particularly with materials whose magnetic permeability is sensibly different from unity. The determination of these properties has received much attention in the case of uniform or homogeneous wires, especially copper. But copper-clad steel wires present quite a new combination of properties in comparison with those with which we are so familiar.

When a homogenous cylindrical conductor is traversed by an alternating current, the current density over the cross-section is not uniform, but weakest at

the axis or center and greatest at the surface or periphery. This unequal distribution is due fundamentally to the fact that elements of the current near the center encounter more self-induction or greater inductive reactance than the elements near the surface, although to direct current the whole cross-section presents a perfectly homogeneous resistance. This crowding of the current away from the axis towards the perimeter results in raising the resistance and reducting the inductance, apparently. That is to say, the whole cross-section is not uniformly useful. This suggests the use of tubular conductors, but it is impracticable in

In the case of copper wires this unequal distribution produces a negligible effect so far as telephone transmission is concerned, and the same is true of aluminum or any other non-magnetic material. The general phenomenon, which is termed the skin effect, increases with the frequency and with the size of conductor, becoming rather appreciable in conductors as large as those sometimes used in high-power transmission, but even here it is not often serious, because of the commonly low frequencies.

But the skin effect in homogeneous magnetic wires is multiplied by the permeability, a fact which makes iron wires of such limited value in telephony. The apparent resistance becomes much larger than the so-called ohmic, or direct-current resistance, and it may also contain a component representing the loss due to magnetic hysteresis and eddy currents, although the latter effects will not be prominent because of the small magneto motive forces and flux densities. The report shows that the permeability of the steel in copper-clad wires compares very closely with the permeability of homogeneous iron and steel wires under like conditions.

Copper-clad wires are novel in the respect that the copper shell normally transmits fully 75 per cent or more of the entire current, which is considerably more than an equal cross-section would transmit in a homogeneous wire. Hence, the skin effect in the steel core, which may of itself be considerable, only affects a relatively small part of the transmitted current; and, moreover, the crowding of current from the core to the shell, by skin effect, transfers it from a steel conductor to one of copper. This accounts for the limited total skin effect in copper-clad wires, amounting rarely to more than 3 or 4 per cent, and explains why such wires are useful and efficient for a large number of telephonic applications.

## *"NICKEL FIRST" IN CHICAGO.*

"NICKEL FIRST" telephones are approved by Prof. Edward W. Bemis, expert, who has been investigating telephone service in Chicago for months and has recently made a special investigation of the "nickel first" telephones at the order of the city council. In a report made to the council committee on gas, oil and electricity he recommended that the installation of the telephones be allowed to continue, but that some method be adopted to avoid difficulties arising over inability of persons to call in case of emergency, as robbery or fire.

Professor Bemis says that as a rule satisfaction has been found in the use of the type of telephone and that only trivial objections are brought against it.

The report shows that of the 264,893 telephones in use in Chicago and connected with the Chicago Telephone Company November 30, 1911, 55 per cent were nickel telephones, either "nickel first" or "nickel last." They were divided as follows:

| | |
|---|---|
| Druggists | 2,329 |
| Other public pay stations | 397 |
| Business one party lines | 4,975 |
| Business two party lines | 24,808 |
| Residence two party lines | 3,204 |
| Residence four party lines | 110,207 |
| Total | 145,920 |

"The total number has nearly doubled in the last three years," says the report. "The 'nickel first' service was first introduced into Chicago in the spring of 1905, at which time all of the main, central and Harrison exchanges were fitted up with these telephones.

"Of 150 inquiries made into the use of this telephone, only thirty-one replies were received to date. Presumably the 119 not replying had no very serious complaints to make. Of the thirty-one replying, thirteen were entirely satisfied, several preferred the 'nickel first' to the 'nickel last' type on account of quicker service. The objections urged in the eighteen unfavorable replies were either that the operator could not be reached without the depositing of a nickel in case of fire or robbery or other emergency, or the loss of occasional nickels and consequent annoyances connected therewith.

"The emergency objection appears worthy of consideration. In July, 1911, there were 1,846 calls for police and 327 calls for the fire department or a total of 2,173 such emergency calls on the 30,000 'nickel first' telephones then in use."

In conclusion the report says:

"While it has not been possible in the time at hand to make an exhaustive study of this important question, it is believed that if the committee would require the company to provide upon request a suitable device for emergency slugs, and a full, printed explanation to be posted on every telephone, telling how to use the telephone and also how to safeguard the nickel, it would be well to permit a further extension of the 'nickel first' telephone if the company can thus save the $18,000 to $25,000 a year that it believes it is now losing from the failure to collect on 'nickel first' telephones. The public will get the benefit of it in the general reduction of telephone rates, since, under the present ordinance the company is only entitled to such rates as will give a reasonable return on the actual investment."

After considerable discussion action on the report was deferred until the next meeting of the committee.

## *RATES RAISED IN CANADA.*

The operation of the Manitoba telephone system for the year 1911 will show a loss of nearly $150,000. The government telephone commissioners will recommend drastic increases in telephone rates. A few years ago the government purchased the property of a private telephone company. After most exhaustive study on the part of the telephone commissioners the government now finds that it must raise telephone rates. In the case of Winnipeg, the largest city in Manitoba, the rates must be increased 50 per cent. The commission finds that the rates for rural subscribers living in the sparsely settled sections of a province are much too low, while the practice of giving free service between adjoining exchanges is wrong.

# Inductive Disturbances on Telephone Lines

By Dr. Burke Smith

WITH the increase in the number of high tension transmission systems throughout the country and the extension of the single-phase railway, the study of inductive disturbances from such sources has become of increasing importance to the telephone engineer. Where the telephone and high-tension systems are in close proximity the disturbance to the telephone may be very troublesome. Although it is not usually necessary to build telephone lines in immediate proximity to high-tension transmission lines or other lines carrying alternating current, nevertheless existing telephone lines are often threatened with trouble from transmission lines projected in their immediate neighborhood.

It is of importance, therefore, to be able to determine in advance of the construction of a high-tension line, what the effect of such a line in the way of induction will be upon telephone lines in the immediate vicinity. It is impossible to determine by calculation in such cases the exact amount of disturbance which may be expected on account of the number of factors which enter into such a problem and the difficulty of obtaining sufficient data on which to base accurate calculations. However, it is of assistance to understand clearly the nature of inductive disturbances and to formulate the theory on which such problems rest. It is the purpose of this article to give a simple discussion of the problem of determining the effect of induction in telephone circuits which parallel high-tension lines and to show how an approximate estimate of such effects may be obtained in certain cases. The formulae derived do not enable one to calculate accurately the effect in every case which may arise, but it is believed that a knowledge of the methods here given will be of assistance in various cases which occur in practice.

In what follows the term "high-tension line" will include power transmission lines, arc lighting circuits, and electric traction lines and feeders.

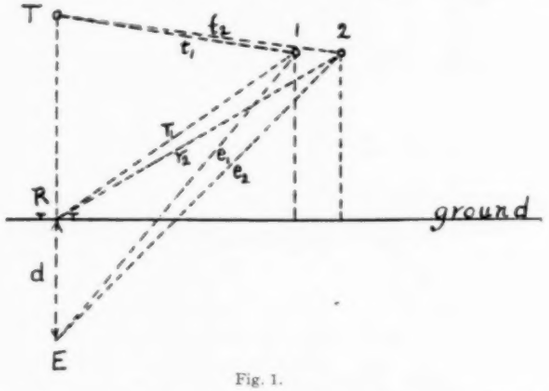


Fig. 1.

In order to form some idea of the number of factors involved in the problem of determining by calculation the amount of induction in a telephone line due to a neighboring high-tension line, we shall enumerate the principal factors which enter into the problem:

In the case of the telephone line, separation between telephone pole line and high-tension line; size and kind of wire; average height of wires above ground; spacing of wires; relative position of wires and number on cross-arms; transpositions; general conditions, such as trees, atmospheric conditions, insulation of lines, character of country, neighboring structures, etc. In the case of the high-tension line. type of line, single-phase or three-phase; if single-phase, grounded or metallic return; if three-phase, delta or star connected; neutral grounded or ungrounded, at

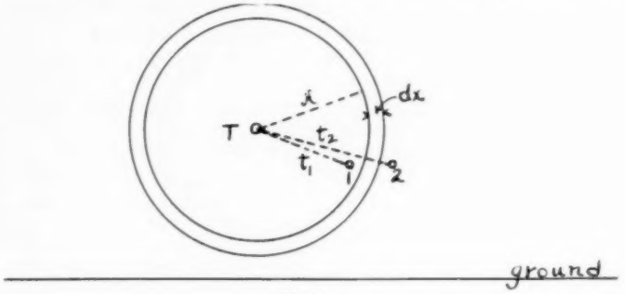


Fig. 2.

one or both ends; average line voltage; spacing and number of wires and arrangement on cross-arms; transpositions; size and kind of wire; average height of wires above ground; frequency; maximum kilowatts transmitted; balanced or unbalanced load; location of substations; wave shape of generators and effect of motor commutators on wave shape.

Of the above factors, the most important are, separation between telephone and high tension line, spacing and transpositions of telephone and high tension wires, leakage from telephone wires, wave shape, voltage, frequency and amount of energy transmitted over high tension line, and if three phase, whether neutral is or is not grounded.

It is evident that it is impossible to take account of all the above factors in any set of calculations or formulas, from their number and nature, but with certain assumptions as to the constants of the circuits it is possible to calculate approximately the magnitude of the voltage and current which is induced in a telephone loop per given length of parallelism with a high tension line. It is difficult to name a value of induced voltage or current, however, which will be a measure of the detrimental effect on telephone transmission since the amount of inductive noise which is allowable in a telephone receiver without interfering seriously with conversation varies greatly with the frequency of the current which actually flows through the receiver. A low frequency current of say 25 cycles through a telephone receiver is very near to the lowest frequency which will give an audible sound in this way and except for overtones a comparatively large current of this frequency through a receiver could give no trouble. On the other hand, a frequency of induced current in the neighborhood of 1,000 cycles per second through a telephone receiver may be very annoying at a current strength of only 10 microamperes.

Inductive disturbances are either electromagnetic or electrostatic in nature. In general both of these effects will be present in the cases which are met with in practice, but since one will usually predominate over the other and since they will not be in phase, no attempt will be made to obtain their combined effect here. To obtain their combined effect the two factors obtained by considering each separately must be combined vectorially.

ELECTROMAGNETIC INDUCTION.

Consider as a typical case under electromagnetic induction a single phase trolley line with single overhead trolley and grounded rail return paralleled by a single untransposed aerial metallic telephone loop with the usual terminal apparatus at either end. In order to calculate the induction due to electromagnetic action the amount of current flowing out from the power house through the trolley and returning in the rails and earth at any given instant must be known. The current which returns through the earth to the power house no doubt spreads out over a large cross-sectional area and it is difficult to determine the distribution of this current in the earth. However, since it is necessary to make some assumption as to the path taken by the current in returning through the earth, we will consider this current to be concentrated along a certain path at a certain distance below the surface of the earth which we will call the "equivalent line of flow."

Represent the trolley wire by $T$ (Fig. 1), a neighboring metallic telephone line by $1$, $2$ and the rail and equivalent line of flow by $R$ and $E$, with distances designated in the figure. Then alternating current flowing in the trolley $T$ will set up a changing magnetic field around $T$, some of the lines of which will tread through the telephone loop. Now the e. m. f. induced in a loop of wire which is threaded by lines of magnetic force is measured by the number of lines which cut the loop per second.

The number of lines enclosed by the loop will vary between zero and a maximum. The flux will, in fact, cut the loop four times during each cycle, twice passing in and twice passing out of the loop. Let $\Phi_{max}$ denote the maximum flux. Then, if $n$ is the frequency in cycles per second $4n\Phi_{max}$ will give the total number of lines of force which cut the loop in one second and this number therefore must be equal to the average value of induced e. m. f. This must be divided by $10^8$ to change from C. G. S. units to volts. We have, then, for the average volts induced,

$$E_{av} = \frac{4\,n\,\Phi_{max}}{10^8}$$

Since the effective e. m. f. is equal to $\frac{\sqrt{2}}{4} E_{av}$ we have for the effective e. m. f. induced in the telephone loop,

$$E = \frac{\sqrt{2}\,n\,\pi\,\Phi_{max}}{10^8} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

The maximum flux $\Phi_{max}$ may be found as follows: Consider the field intensity at a radius $X$ from the center of the trolley wire $T$. By Biot and Savart's law the strength of field at a radius $X$ from a long cylindrical conductor carrying a current of $I$ amperes is equal to $\frac{.2I}{x}$. Hence the flux per unit length of conductor in a ring of width $dx$ and radius $X$ (see Fig. 2) is $\left(\frac{.2I}{x}\right) dx$. Calling this $d\Phi$ to get the total flux $\Phi$ which threads through the telephone loop we integrate between the limits $t_1$ and $t_2$, or

$$\Phi = \int_{t_1}^{t_2} \frac{.2\,I}{x}\, dx = .2\,I \log_e \left(\frac{t_2}{t_1}\right)$$

per centimeter length of telephone circuit. To get the maximum flux we take maximum current, i. e., put $\sqrt{2}I$ in place of $I$. If then we substitute in (1) we have for the effect induced volts per centimeter length of telephone loop,

$$E = \frac{.4\,n\,\pi\,I \log_e \left(\frac{t_2}{t_1}\right)}{10^8}$$

Changing to 1,000 foot lengths and using common logarithms this becomes,

$$E = \left(\frac{88.24\,n\,I\,l}{10^5}\right) \log_{10} \left(\frac{t_2}{t_1}\right) \quad \ldots\ldots\ldots (2)$$

when $n$ = cycles per second frequency of current in trolley.

$I$ = amperes (effective) flowing in trolley.

$l$ = length of parallelism of trolley and telephone line, in 1,000 foot units.

$t_1, t_2$ = distance of telephone wires from trolley $T$.

The voltage induced by the return current flowing in rails and earth may also be calculated by the use of (2). If we assume that 75 per cent of the return current follows closely along the rails, the other 25 per cent following the "equivalent line of flow" through

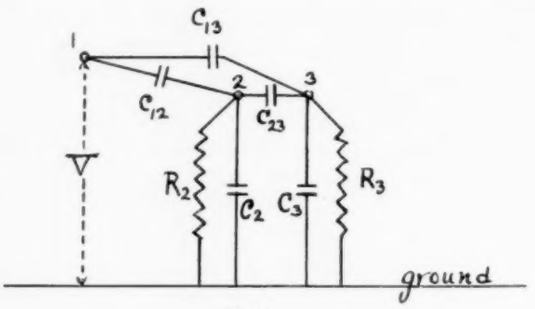


Fig. 3.

the earth, the formula for the complete inductive effect then becomes

$$E = \frac{88.24\,n\,I\,l}{10^5}\left(\log\left(\frac{t_2}{t_1}\right) - .75\log\left(\frac{r_2}{r_1}\right) - .25\log\left(\frac{e_2}{e_1}\right)\right) \quad (3)$$

Apply this formula, as an example, to calculate the induction in a telephone line with grounded return paralleling a 25 cycle single phase trolley line for 1,400 feet.

Assume current flowing in trolley....60 amp.
Average height of trolley above ground .....20 ft.
Average height of telephone wire above ground .....35 ft.
Horizontal separation between trolley and telephone wire.....25 ft.

In this case since the telephone circuit has a grounded return we may assume that the equivalent

line of flow of the telephone return is so far away that $t_2 = r_2 = e_2$. Formula (3) then becomes:

$$E_{\text{eff}} = \frac{88.24\ n\ I\ l}{10^5}\ (.75 \log r_1 + .25 \log e_1 - \log t_1)\ \textit{volts}$$

Assuming that the equivalent line of flow of the current returning through the earth is 1,000 feet below the surface of the ground, we have $t_1 = 29.16$; $r_1 = 43.01$; $e_1 = 1{,}000$; $l = 1.4$; $n = 25$; $I = 60$, which gives, on substituting, $E = .94$ volts effective.

If we assume that all the current returns by way of the rails, $e_2 = r_1 = 43.01$ and the induced voltage

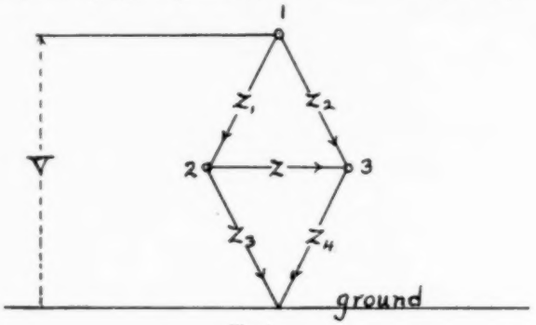


Fig. 4.

according to the formula is $E = .31$ volts. The true result is probably somewhere between these extremes, although the first value agrees well with values which were actually observed in one case.

The amount of current which such a voltage would produce in the receiver at a subscriber's station at the end of the line would depend upon the impedance of the telephone line and terminal apparatus. Owing to the low frequency of the fundamental in the above case, which is scarcely higher than that of ringing current, the only annoyance which would be experienced would be due to the harmonics which are always present to a greater or less degree.

If, instead of a single telephone wire with grounded return, we have in the above problem a metallic telephone circuit consisting of two wires, spaced one foot apart, we should have in addition to the values of $t_1$, $r_1$, $e_1$, above,

$$t_2 = 30.01$$
$$r_2 = 43.60$$
$$l_2 = 1{,}000$$

Substituting in (3) we have as the induced voltage, $E = .015$ volts which is only 1.6 per cent of the induction which occurs with grounded return. This induction could be eliminated by proper transpositions.

The application of formula (2) to other examples and conditions is obvious. In the case of electromagnetic induction from three-phase, three-wire transmission lines, the effect from the current in each wire of the transmission line can be calculated separately and the results added, care being taken to allow for phase displacement between the currents induced from each phase. However, except with three-phase lines operated with grounded neutral at each end the net result will in general be small, due to the neutralizing effect of the three-phase currents. Lines with neutrals grounded at each end may cause trouble due to the third harmonic current of triple frequency which flows in all three wires in parallel. The effect of this third harmonic may be calculated as above.

We might make assumptions other than the above as to the path and amount of current which returns through the earth. There is also the effect of eddy currents which circulate through the earth and tend to make the flux $\Phi$ smaller than we have assumed in deriving (2). However, formula (2) should be considered only as of use in obtaining approximate results on account of the uncertainty in the factors involved.

ELECTROSTATIC INDUCTION.

The calculation of the effect of electrostatic induction is a more difficult problem than the calculation of the effect of electromagnetic induction. This is due in part to the complexity of relationship between different conductors as the number of conductors which has to be considered is increased. When a transmission line connected to a source of electromotive force at one end is paralleled by other wires, charges will be induced on these wires by electrostatic induction. When the source of electromotive force is an alternating current generator, due to the changing electrostatic field around the conductors with change in sign of the e. m. f. of the transmission line during each cycle, these charges will change in sign once in each cycle. In the case of telephone wires, the flow of current in the conductors which follows these changes in sign of the induced charges is the source of the disturbing effect.

In order to develop formulas which will give the amount of current thus flowing in a telephone circuit which parallels a high tension line, consider a single phase transmission line with ground return, paralleled by a single metallic telephone circuit, with the usual terminal apparatus at each end. Each wire will have capacity with reference to the other two wires of the system and ground, and we shall have a net work of air condensers as shown in Fig. 3. In this figure the insulation leakage of the telephone wires to ground, where such leakage is appreciable, is designated by $R_2$ and $R_3$, and the voltage of the transmission line by $V$.

The condenser $C23$ due to the mutual capacity of the wires 2 and 3 is shunted by the telephone terminal apparatus at each end. Each wire will, in addition, have capacities to all other wires and structures which are in the vicinity. We shall however consider for the present only the capacities shown. The net work composed of the three wires and ground as shown in Fig. 3 may be considered as a Wheatstone's bridge (Fig. 4), $V$ denoting the potential of the transmission line to ground and $z_1$, $z_2$, $z_3$, $z_4$, the impedances of the bridge arms. The telephone terminal apparatus in parallel with the condenser $C23$ will form the branch 2, 3. The impedance of $C23$ being in general very much greater than that of the terminal apparatus we may consider the branch 2, 3 as consisting of merely the terminal apparatus of impedance $z$. The problem is then, to find the current flow between conductors 2 and 3 through the impedance $z$ with a given impressed voltage $V$ between conductor and ground.

Let $i$, $i_1$, $i_2$, $i_3$, $i_4$ be the currents flowing in the respective branches $z$, $z_1$, $z_2$, $z_3$, $z_4$. According to Kirchhoff's laws the sum of the potentials around any network is equal to zero.

Accordingly,

$$\begin{cases} z_2 i_2 - z i - z_1 i_1 = 0 \\ z i + z_4 i_4 - z_3 i_3 = 0 \\ z_2 i_2 + z_4 i_4 - V = 0 \end{cases}$$

Substituting $i_4 = i + i_2$ and $i_3 = i_1 - i$ and solving for $i$ we have,

$$i = \frac{(z_1 z_4 - z_2 z_3) V}{\Delta} \quad \ldots\ldots\ldots\ldots (4)$$

where $\Delta = z z_3 (z_2 + z_4) + z_2 z_4 (z_1 + z_3) + z_1 (z + z_2) (z_2 + z_4)$

Equation (4) gives the induced current per unit length of line flowing from one side of the telephone circuit to the other through the terminal apparatus. This equation may be simplified for approximate results as follows: Since the impedance of terminal apparatus is small compared with the impedances $z_1$, $z_2$, $z_3$ and $z_4$ we may neglect the terms which contain $z$ in equation (4) and have

$$i = \frac{(z_1 z_4 - z_2 z_3) V}{z_1 z_3 (z_2 \times z_4) + z_2 z_4 (z_1 + z_3)} \quad \ldots\ldots\ldots (5)$$

Since $i$ and $V$ are vector quantities we must write

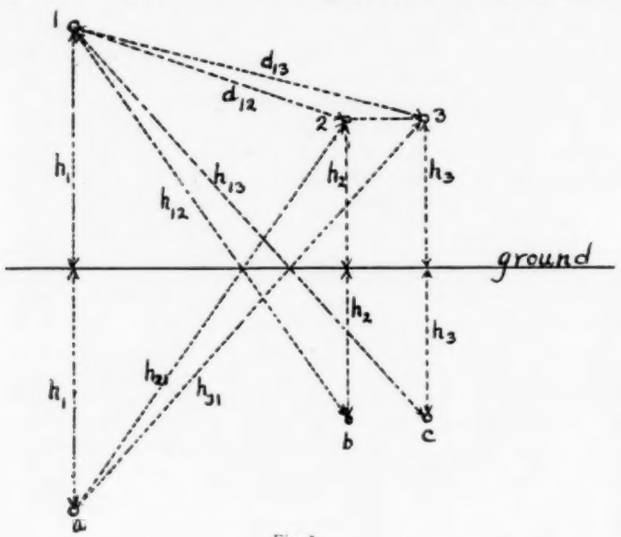


Fig. 5.

$z_1$, $z_2$, $z_3$, $z_4$ each in symbolic rotation, that is, in the form $a + jb$ where $j = \sqrt{-1}$, the numerical value being $\sqrt{a^2 + b^2}$. Using this notation we have

$$\left.\begin{aligned} z_1 &= \frac{j}{w\ C_{12}} \qquad z_2 = \frac{j}{w\ C_{13}} \\ Z_3 &= \frac{R_2 (1 + j\ R_2\ w\ C_2)}{1 + R_2^2\ w^2\ C_2^2} \quad Z_4 = \frac{R_3 (1 + j\ R_3\ w\ C_3)}{1 + R_3^2\ w^2 C_3^2)} \end{aligned}\right\} (6)$$

where $w = 2\pi n$, $R_2$, $R_3$, are in ohms and the capacities are measured in farads. When there is no insulation leakage, that is when $R_2 = R_3 = \infty$ we have $z_3 = \frac{j}{w\ C_2}$ and $z_4 = \frac{j}{w\ C_3}$

In order to use equation (4) or (5) for numerical calculation it is necessary to know the capacities $C_{12}$, $C_{13}$, $C_2$ and $C_3$. Fomulas for the calculation of capacities of suspended wires have been published. However, on account of the complexity of these formulas, it is a very laborious undertaking to compute the capacities where more than three wires are involved. Furthermore, if, in addition to the particular wires considered, the effect of other neighboring wires or structures is not taken into account the calculated capacities may differ from the true values in some cases by large percentages. We may obtain results however, by using calculated values of the capacity for three wires without taking account of other neighboring wires which will serve to show the order of magnitude of the induced current and the comparative effect under different conditions.

Convenient formulas for the calculation of capacity of suspended wires have been given by Frank F. Fowle in the *Electrical World* for August 12, 1911. Referring to this article we may write down the capacities which we need here:

$$\left.\begin{aligned} C_2 &= K\left(\frac{u_{11}\ u_{33} - u_{13}^2}{D}\right) \quad C_3 = K\left(\frac{u_{11}\ u_{22} - u_{12}^2}{D}\right) \\ C_{12} &= K\left(\frac{u_{13}\ u_{23} - u_{12}\ u_{33}}{D}\right) C_{13} = K\left(\frac{u_{12}\ u_{23} - u_{13}\ u_{22}}{D}\right) \end{aligned}\right\} (7)$$

where $K = .07766$ and the results are in microfarads per mile, $D = u_{11}\ (u_{22}\ u_{33} - u^2_{23}) - u_{12}\ (u_{33}\ u_{12} - u_{13}\ u_{23}) - u_{13}\ (u_{22}\ u_{13} - u_{12}\ u_{23})$

$$\text{and } u_{xy} = 2\ log\left(\frac{h_{xy}}{d_{xy}}\right)$$

$$u_{xx} = 2\ log\left(\frac{2h_x}{r_x}\right) \quad xy = 1, 2, 3$$

$r$ is the radius of the wire and $h$ and $d$ have values shown in Fig. 5.

Applying these formulas to the case of a telephone circuit consisting of a single pair of No. 12 N. B. S. copper wires carried on crossarms 30 feet above ground paralleling a single No. 0000 copper wire 40 feet above ground, we obtain for $C_{12}$ and $C_{13}$ the values shown in the curves in Fig. 6, which are based on various horizontal separations. $C_2$ and $C_3$ are practically constant for separations greater than 10 feet and equal .0115 microfarads per mile. With 40 feet separation we have from the curves:

$C_{12} = .000540$ mfds per mile.
$C_{13} = .000508$ mfds per mile.
and $C_2 = .0115$ mfds per mile.
$C_3 = .0115$ mfds per mile.

Assume now, for example, the No. 0000 copper wire carries a 60 cycle single phase current with potential $v$ to ground. Assume also that there is no leakage, that is, $R_3 = R_4 = \infty$. Then the impedances through the air condensers are, from (6),

$z_1 = 4.912 \times 10^6 j$ ohms per mile.
$z_2 = 5.222 \times 10^6 j$ ohms per mile.
$z_3 = 0.2306 \times 10^6 j$ ohms per mile.
$z_4 = 0.2306 \times 10^6 j$ ohms per mile.

Substituting these values in formula (5) we have for the induced current flowing from one side of the telephone line to the other through the terminal apparatus at the two ends, for each mile of parallelism

$$i = .0058 \times 10^6\ V\ j \text{ amperes.}$$

or .0058 microamperes per volt of transmission line impressed voltage. This current will be divided between the terminal apparatus at the two ends of the telephone loop so that the current flowing through a telephone receiver at either end will not be more than 3 microamperes for each 1,000 volts potential to ground of the single phase line and for each mile of parallelism of the two lines. This is a very small cur-

rent and can be practically eliminated by transpositions.

In case there is an appreciable leakage to ground from the telephone wires—a condition which practically always obtains on an actual line—the value of induced current will in general be greater. Thus if we assume in the above example a leakage of $R_2 = 10$ megohms per mile from one side to ground and $R_3 = 1$ megohm per mile from the other side to ground, which is a condition by no means uncommon on actual lines, we have from (6)

$z_1 = 4.912 \times 10^6 j$ ohms per mile.
$z_2 = 5.222 \times 10^6 j$ ohms per mile.
$z_3 = 10^6\ (.00532 + .230\ j)$ ohms per mile.
$z_4 = 10^6\ (\ .0505 + .219\ j)$ ohms per mile.

Substituting in (5) we have as before, the induced current through the telephone terminal apparatus. Substituting in this formula we have,

$$i = \frac{(.0452 - .011\ j)\ V}{10^6\ (-2.373 + 3.08\ j)}$$

This expression can be most conveniently simplified by reducing numerator and denominator each to real values, and we then have,

$$i = \frac{(.0465)\ V\ \underline{|13^\circ\ 41'}}{10^6\ (2.392)\ \underline{|7^\circ\ 24'}} \text{ amperes}$$

which reduces to

$i = \left(\frac{.0194}{10^6}\right) V$ amperes with phase angle of $-6^\circ\ 17'$

This would amount to 194 micro amperes for a line voltage of $V = 10{,}000$ volts.

This is nearly four times as much current as we found by assuming that there was no leakage.

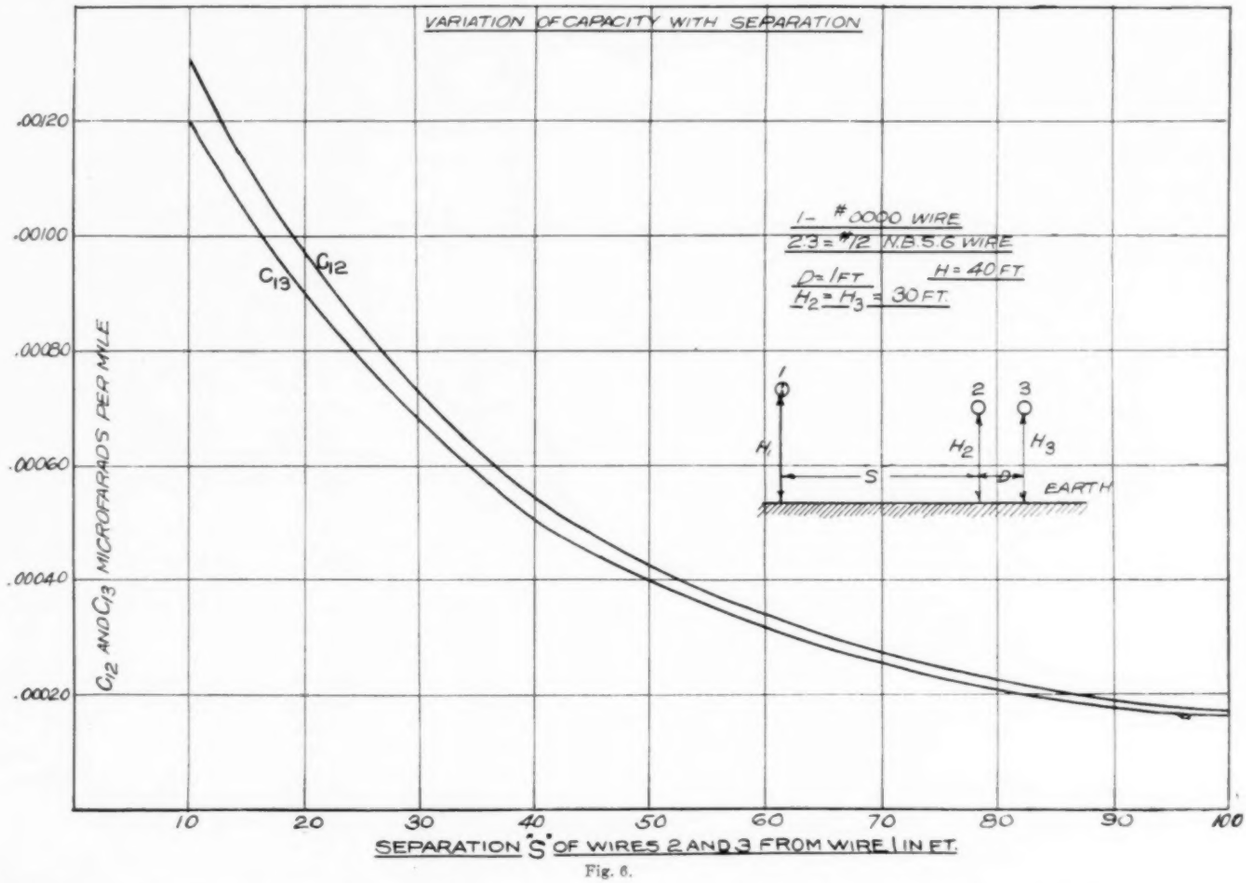


Fig. 6.

However, we have not allowed for transpositions, and since telephone lines are usually well transposed, we may average $C_{12} = C_{13}$ and have,

$C_{12} = C_{13} = .000524$ mfds per mile,
and $C_2 = C_3 = .0115$ mfds per mile.
Thus, for a transposed line,
$z_1 = z_2 = 5.062 \times 10^6 j$ ohms per mile.
$z_3 = 10^6\ (.00532 + .230\ j)$ ohms per mile.
$z_4 = 10^6\ (\ .0505 + .219\ j)$ ohms per mile.
Since $z_1 = z_2$ we may write (5) in a simpler form, thus:—

$$i = \frac{(z_4 - z_3)\ V}{z_2\ (z_3 + z_4) + 2\ z_3\ z_4}$$

It should be noted that we get this large increase in induced current notwithstanding our assumption that the telephone line was transposed. It thus appears that transpositions do not help matters much in such cases since the leakage or unbalance is transposed along with the conductors.

The importance of good insulation and balance on lines exposed to induction is evident from this example. However, it is not always easy to maintain telephone lines in a satisfactory condition of insulation and balance. Moreover, if the leakage or unbalance occurs anywhere along the line, whether at the point of exposure or elsewhere within reasonable limits, the effect at the ends will be the same except

for the attenuation of the induced current due to the impedance of the telephone line.

We have assumed a single phase transmission line in the above examples. In the case of a three wire three phase line the effects from the voltage in each wire of the transmission line can be calculated separately and the results added, care being taken to allow for phase displacement between the currents induced from each phase and to calculate the capacities correctly. However, in general, due to the neutralizing effect of the three phase currents the net result will be small. If the neutral of the transmission line is grounded at one end, however, there may be a large disturbing effect from the third harmonic which is present in all three conductors in parallel under certain conditions.

# Going Value of Public Utilities

By Frank F. Fowle*

GOING value is important in both its legal and its economic aspects, but particularly the latter, because it is one form of value and is thus property as much as though it had physical existence. We are probably accustomed to think of going value primarily in connection with appraisals of public utilities, but in order to maintain our ideas in proper balance we ought to recognze that going value may exist in a business of any kind, irrespective of tangible or physical property. In general going value has been taken to mean that element of value which is created by an active or going business, in addition to the tangible investment for property and working capital. It exists by reason of the fact that there is a live, productive business, and it would cease when the business ceased, even though the property could retain at the same time a value equal to its structural cost. The differences of opinion arise when we come to measure the amount of going value or attempt to formulate a rule for determining it. Some students of the problem have gone so far as to imply that going value is really inherent in the plant. This view of the matter is difficult to accept because it sets aside the question of earnings.

Regardless of the kind of business to which they apply, the principal methods may be set down as follows:

1. Capitalizing the net earnings.
2. Finding the cost of reproducing the net earnings.
3. Capitalizing the early losses.
4. Capitalizing the cost of securing business.
5. Over-capitalization of consolidated companies.
6. Miscellaneous.

All of these methods but the first have been proposed mainly in reference to public utilities, where the problem of going value has raised so much discussion. Some of the difficulties surrounding the subject are probably due to the ingenious arguments put forward by those who have sought to maintain values or earnings which were threatened with reduction under the cost of service theory. Perhaps the sanest point of view can be maintained by discussing first the natural method of finding the going value in a private business, from the standpoint of the owner or investor.

The first method applies to all kinds of private business, and in one sense it applies to public utilities also, but under the cost of service theory it excludes any going value which can be capitalized for the purpose of earning a return. This is the common-sense definition of going value in general business; it rests absolutely on earnings in excess of the expected or usual return on the tangible property. Where such a return does not exist there can be no going value in the sense here defined, and if the net earnings do not equal the expected rate of return the going value will be negative; that is to say, the investment value will be less than the cost of the tangible property. Value is here established and measured entirely by net earnings, without regard to cost of the tangible property.

The rate of return which is regarded as reasonable depends upon local circumstances, but in the main it covers both the ordinary interest rate on secure investments and a margin of speculative profit; this is necessary to attract capital and stimulate development. The total return generally allowed is 7 to 8 per cent. This makes it possible, with certain forms of financing, to show a margin of going value. Under the rule that a property should not be bonded beyond the point where the interest exceeds one-half of the net earnings, the stock can be made to show more than the rate of return allowed on the whole property.

In the reproduction of net earnings method the general supposition is that on the date of appraisal the existing plant and all of its business will be suddenly wiped out, and then work will be commenced at once to reproduce the physical property just as it was before, and the business which the old plant had will be acquired by the new one as fast as possible. The community served, however, is not presumed to change in any way from its present size and character, except through natural growth. Obviously some time will elapse before the revenues of the new plant will catch up with the probable revenues of the old one, and thus the act of reproducing the going business will entail some loss during the first few years. This method aims to determine the probable extent of that loss and then reduces the total amount by discounting it at compound interest to its present value, and calls that the present worth of the going value.

The general procedure is to plot the total revenue, the commercial revenue and the operating expenses from the inception of the business to date, or else far enough into the past to establish a safe guide for the future. The revenues from public service, such as fire hydrants or street lighting, are not taken into consideration, because it is assumed that these can be reproduced as soon as the new plant is ready for operation, thus entailing little or no loss. The commercial revenues and the operating expenses of the present plant are projected into the future, and by means of curves

*Abstract of a paper read before a joint session of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers, Chicago, Nov. 22, 1911.

showing the established revenues and the expenses of the new plant the date is found on which the revenues of the two plants will become equal.

This reproduction of net earnings method has never, so far as the author is informed, received the sanction or indorsement of the Wisconsin commission. But the fact that it has been accepted in other cases entitles it to our serious consideration. It can be said in the first place that it measures no element of direct cost in building up a going business, and it bears no relation to the past profits or the losses; and, in fact, there may be a going value, under this theory, in an unprofitable business. What the method really does determine seems to be this: It estimates the loss of income which would result if the present service contracts and connections were suddenly wiped out, along with the physical plant, and then re-established as fast as possible after the completion of the duplicate plant, assuming that the public appreciation of and demand for the service proceeds as though there had been no change. But such a loss of income tells us neither the actual outlay or investment for building up the original business or the reproduced business, and hence it seems to be not in keeping with the cost of service theory.

It is always a safe test of any theory of going value to inquire whether a prospective investor would recognize it and put his money into the value thus determined. If an engineer were asked by an investor to make a private report on some utility property it is extremely improbable that he would apply this method of going value and submit it along with the estimated tangible value to his client. The measure of going value from the investor's viewpoint is earning value, present or future, and nothing else.

The author's conclusion in regard to this method, after much study of it, is that it measures no element of value which can be considered under the cost of service theory of rates. It might be admissible, however, under the value of service theory, where cost is not a primary consideration.

As to the capitalized losses method, it is well known that many public service companies failed to earn a reasonable return during their early existence, particularly those which commenced business many years ago. These companies are now reaching the period when their present and future returns will be regulated in accordance with the cost of service theory. This raises a question of equity, because the pioneers who have failed up to this time to recoup their early losses from later profits are now denied the opportunity to recoup themselves in the future. On the face of it this would seem to be unjust, and consequently there has been a tendency to hold that a public utility is rightly entitled to a fair return on its tangible property from the day it commenced operation down to the present moment. If, in fact, there were such early losses they would now be capitalized, with interest, under this policy and included in the value upon which reasonable returns ought now to be computed. This is the plan which has been approved by the Wisconsin commission, under the name of going value. The selection of the name for this increment of value is not a particularly happy one, because it is not going value in the usual sense, but rather the capitalized value of deferred profits.

There can be no question that the requital of early losses by later profits is entirely equitable, but in case these profits should be so large as entirely to wipe out the losses and furthermore reduce the earning value to a point below the reproduction cost of the tangible property, the matter of equity needs further consideration. Under the Constitution private property may not be taken for public use without adequate compensation, and the question here is whether previous returns in excess of a reasonable rate may be construed as lawful compensation for now fixing a value which is less than the reproduction cost of the property. It is difficult to see why such a construction would not amount to confiscation and thus be unlawful, especially where the present owners or investors did not realize the extra profits. But, even granting that it is not confiscation, as much care should be exercised to make sure that the present owners were the recipients of unreasonable profits in the past as would be expended in the opposite case in making sure that the present owners sustained the early losses.

Early losses and profits may be wholly disregarded, from a new point of view, on the grounds that former times constituted a speculative period, and those who embarked in public utility enterprises expected no more than the usual fortunes of business, pocketing their losses along with the profits as part of the game. Of course the underlying motive in capitalizing deferred profits at the present time is the desire to do justice to the pioneers who invested their money in public utilities and have never had a reasonable return. This is simply the spirit of the square deal, but we should proceed with caution in order to make sure that justice and equity are truly served.

With the merged securities method, it is sometimes the case that two or more utilities are merged and capitalized for more than the cost of the tangible property. This may be a case of necessity owing to over-capitalization of the merged companies, or it may be deliberately planned by the promoters of the merger.

Under the principle that a public utility ought to be a local monopoly, it is the duty of the public not to force competition unless the company which occupies the field is failing in its public obligations; otherwise the company is entitled to protection. If, nevertheless, a competing and unnecessary franchise is granted and a substantial property is built thereunder there is very likely to be a duplication of property and investment by the two companies. A subsequent merger will then result in all probability in a capitalization in excess of the cost of the tangible property which the consolidated company finds it necessary to retain and operate. Sooner or later the time will arrive when the consolidated company comes under regulation. Then it becomes necessary to pass on the validity of any intangible capital which came into existence with the merger.

On the ground that the public is responsible for the duplicating of property in mergers of competing utilities, it seems just and equitable to allow a going value to the extent of the unavoidable duplication at the time of consolidation.

Next is the cost of development method. The development and upbuilding of any business commonly calls for expenditures beyond those which represent tangible property. Thus there is the matter of advertising and display to educate the public. Special in-

ducements to try the service are quite common, such as free house piping, or the installation of piping or wiring at the cost of labor and materials, or less than cost, with a long period in which to pay on the installment plan; also the sale at less than cost of various household utilities which consume water, gas or electric energy; and sometimes the use of free water, gas or electricity is offered for a limited period. There is also the matter of canvassing to obtain business, and to show consumers how to utilize the service economically and at the same time effectively. Such costs may have been charged to capital or to operating expense, but in either case it seems necessary to consider them as one of the legitimate elements of cost, under the cost of service theory. The Wisconsin commission has expressed substantially this view of the matter, in connection with discussions of going value.

As regards latter day practices, it may be observed that the cost of getting business is divisible, at least for discussion, into two parts; one covers the expense for holding the present volume of business and the other covers the expense of securing an added volume of business. It has been proposed that the first part should be charged to operating expense and the second part to construction or capital account. Such a division seems to be equitable enough, but there is some doubt as to whether it is altogether conservative. The creation of intangible values, or the addition to physical values of expenditures which do not represent physical property, ought to be restrained rather than encouraged. In other words, it cannot be regarded as conservative to attempt to build up values which do not represent tangible property. Therefore, there is good reason for charging the cost of securing business to operating expense.

Whichever way we conclude the matter, selling cost, or the cost of building up and holding a going concern, is a legitimate outlay which we must recognize under the cost of service theory. In the case of an adjustment of rates at this time, the form or manner in which we recognize it is not so essential as the fact. Again we may observe that this is not going value in the broad sense, but simply an element of cost which demands recognition.

A variety of miscellaneous methods of arriving at the going value have been proposed from time to time. A going value was claimed, in one instance, equal to one-half of one year's gross receipts. Another method proposes to fix the going value arbitrarily at one-third of the value of the physical property. This leaves out of consideration the net earnings and the cost of developing the business. It has also been proposed to assign a going value on the basis of so much per connected customer. Another proposal was made to fix the going value at an amount anywhere from one-half up to the full sum of one year's gross receipts, on the ground that utility managers would be willing, ordinarily, to spend as much as that to secure the business.

These several methods can perhaps be classified in a general way by saying that they would be admissible under the value of service theory of rates, but not under the cost of service theory, except in so far as they reveal, if at all, any legitimate elements of cost in building the properties and developing the business.

CONCLUSIONS.

1. Under the cost of service theory we seem bound to recognize every element of actual cost, for both tangible and intangible property, which is legitimate, reasonable and necessary.

2. Going value, under the cost of service theory, cannot be supported by capitalized net earnings in excess of a fair return on the cost value of the property.

3. Rigid rules of measuring the legitimate going value, if any, under the cost of service theory, cannot safely be laid down, because the local circumstances in each case are different and each issue should be treated on its merits.

4. The general test for value of any kind, under the cost of service theory, is always the cost, but this may be tempered by the great desirability of distributing justice and equity to both the public and the utility companies, in equal measure.

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## Brooklyn Druggists Demand Greater Percentage

A polite refusal to give the Brooklyn druggists the higher commission demanded for telephone service is contained in a statement issued by the New York Telephone Company. The druggists recently issued an ultimatum that they would have their public telephones taken out if the higher commissions were not allowed.

The statement says:

The New York Telephone Company has always tried to furnish adequate public telephone facilities for the casual user. Public telephones form an essential part of any comprehensive telephone service, and it has always been our desire to treat our public telephone agents with fairness and liberality. The company allows 20 per cent of the receipts as commission where there is no coin collecting device, agents collecting the toll from patrons, remitting same to the company, less commission, on monthly bill. In cases where coin-boxes are furnished the commission is 10 per cent of the gross receipts. With the coin-box the services performed by the telephone agent are reduced to the minimum. Naturally, the agents are called upon to make change, and afford to patrons other courtesies of the sort which they would be glad to afford those patronizing their premises, and which, it would seem, would surely make friends for the agent and add to his general business popularity.

The public telephone agents are listed in the telephone directory, so that incoming calls are received over public telephones, and send their own calls at public telephone rates, less the commission. Our agents frankly admit that the public telephone attracts trade to their stores, and that the commission is only one of the benefits accruing to them from having the public telephone.

The drug stores afford us very desirable places for public telephones, but they are only one of a number of classes of stores which we cover. It is not possible for us to consider settling with the druggists on any different commission from that allowed other classes of public telephone agents. The present rates of commission have been generally effective for a number of years; within the last year the arrangement has been liberalized to some extent by doing away with guarantees which were sometimes required in cases where the earnings from a telephone were doubtful, as well as by allowing agents 10 per cent on receipts for Western Union Telegraph messages, which may now be transmitted over public telephones.

We have had several conferences with representatives of the druggists' associations in an attempt to convince the druggists that our present commission arrangements are as liberal as the company can consistently make them. We believe that the rate of commission demanded, from 20 to 30 per cent of the receipts, is unwarranted, and we intend to continue our efforts to get the druggists to take a more reasonable view of the matter. We should be very sorry, indeed, to see the public telephones removed from these very desirable locations.

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Tripoli, which is the center of the war between Italy and Turkey, has only seven telephone stations. The system is operated by the military department. The country has 3,150 miles of telegraph.

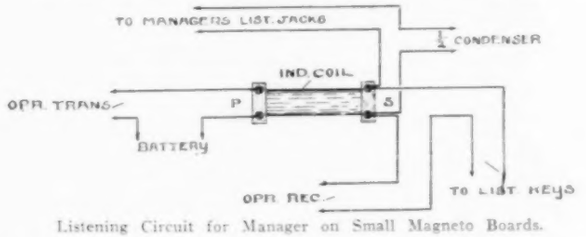
# The Telephone Scrap Book

## Manager's Monitor Circuit

MANAGERS in the small exchanges are often harassed by operators who seem to think that they are running the telephone service instead of he, and quite frequently an innocent operator has to shoulder blame that belongs elsewhere. So the manager often wishes that he had means whereby he could know what was going on in the switchboard room at all times. F. L. Whitaker, Etna Green, Ind., gives us a suggestion, and it is quite easy to install, being somewhat similar to the monitor's circuits in the large exchange. The figure shows the ordinary magneto board operator's circuit.

Run a pair of wires to office or home and terminate them in a metallic jack after having passed a pair of large surface carbon arresters, one at the office and one at the switchboard. This circuit is tapped or bridged to the secondary coil on the board after having passed through a half micraforad condenser. Should the line at any time become short, this condenser will prevent it interrupting the operator's circuit.

If more than one operator, run an extra pair of




Listening Circuit for Manager on Small Magneto Boards.

wires for each coil. The arrangement will be found very useful in securing information which the manager should have at all times.

By connecting to the secondary direct, any conversation carried on in the vicinity of the transmitter may be distinctly heard over the new circuit. The manager's set may consist of a head-band receiver, a six-foot card and plug.

## Discarding the Blue Vitriol Battery

DANIEL or gravity cells, commonly used on magneto switchboard transmitters, are no doubt most economical for this particular place, yet they make a very dirty battery and one subject to many mishaps.

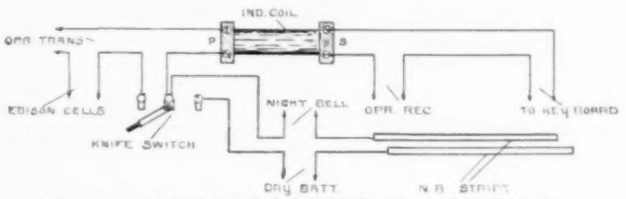
In the average exchange where the blue stone cell is used it seldom gets the attention required, and one usually finds the battery rack covered with creeping salts and the whole battery often in poor condition.

The Edison cell, such as is used on the Warner Pole Changer everywhere, is beginning to come into use in many exchanges for switchboard transmitter work and bids fair to replace the crow-foot type entirely.

A pair of these cells will operate a local battery transmitter from four to eight months, and even longer, without any attention other than the first charge.

If the battery is to be used for any length of time it may be necessary to modify the switchboard circuit in order that the cells may have a chance to rest occasionally, and how to do this is told our readers by F. L. Whitaker, Etna Green, Ind.

The average board is wired with a battery cut out in the operator's jack, which is intended to relieve the battery upon removal of operator's plug. This circuit would be sufficient, but operators, as a rule, forget to




Arrangement of Magneto Switchboard Circuit to Save Batteries.

remove the plug, and consequently battery must flow all night, even when the board is idle.

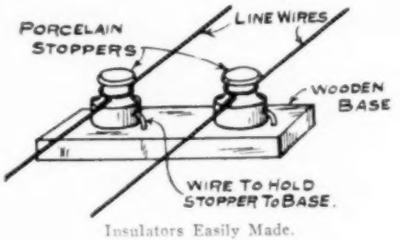
To provide an arrangement whereby the batteries will be cut out when the service is off, which usually takes place on exchanges under five hundred telephones between the hours of 10 and 5 o'clock at night, it is necessary to cut in an extra switch. This should be a single point, double throw knife switch. By referring to the accompanying sketch the scheme is perfectly plain.

It being necessary for the night operator to switch the night bell into the board upon retiring, and by so doing the transmitter circuit must necessarily be cut out, thus giving the batteries a rest as long as the bell is connected.

While this arrangement affects quite a saving in battery, it is important that the resistance of the transmitter be as high as possible; that is, it being a low resistance instrument anyway, see that the set does not consume more current than it really needs. This bad feature is frequently found in some makes of transmitters.

## A Cheap Insulator

A GOOD little insulator, suitable for small telephone lines, is illustrated in *Modern Electrics*. It can be easily and cheaply made by taking the porcelain




Insulators Easily Made.

stopper, generally used on beer bottles, and after removing the heavy wire and rubber attaching it to a wooden base, as shown in the diagram.

## An Interesting Cross Arm Test

IN ASHEVILLE, N. C., is a school that has a branch in Darmstadt, Germany. Its name is "Biltmore School of Forestry," and its aim is to teach practical and theoretical forestry by visits to the actual scenes of operation. Last summer the whole school, consisting of forty boys, visited the Pacific coast and spent six weeks at the C. A. Smith mill at Marshfield, Wash. Then they started back to New York to ship for Germany. At Centralia, Wash., there was a stop over between trains, and the boys visited the plant of the Eastern Railway and Lumber Company, where they witnessed a test of cross arms, the product of the American Cross Arm Company. They were so interested that they went to the offices of the company and heard W. A. Hubbard lecture on the use of fir where strength, durability and light weight are essential.

During the tests at the Eastern mill the boys were made use of in a very interesting manner, the idea being to show what fir cross arms will stand in the way of weight. A regular arm was "framed" in the usual manner, except that for convenience the brace was attached above instead of below. An iron cable was run through the sixth and tenth pins over the arm and under a heavy lumber truck, suspending the truck a few inches above the floor. From each corner of the truck a wire was run to the arm to keep the truck horizontal. By this manner of suspension, with half the weight on the end pin and half on the center pin, the weight the arm would carry if suspension had been from the five pins on the half arm was approximated.

In the first test thirteen boys were seated on the truck. The boys weighed 1,932 pounds and the truck 417 pounds, a total of 2,349 pounds. The cross arm scarcely bent at all under this enormous strain. The

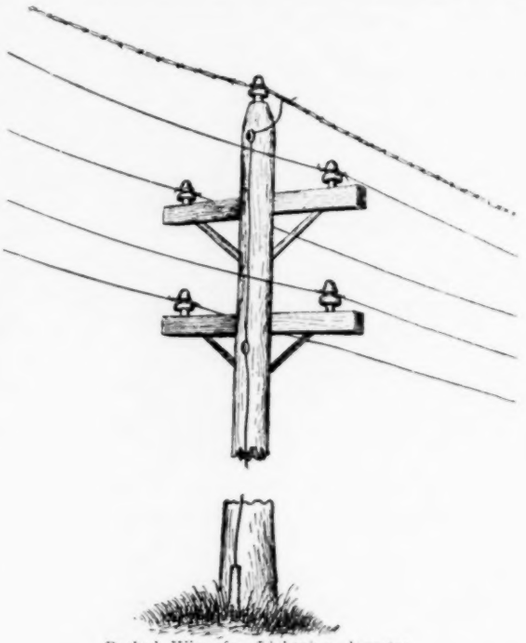
Sixteen Boys on One Cross-Arm.

second test was made by using sixteen boys, with a total suspended weight of 2,804 pounds. The arm bent, but would obviously have carried much more weight before it broke. The heel bolt through the brace on the beam above the arm started to bend, however, and threatened to pull out, so the weight was not increased.

These tests, simple as they were, gave astonishing evidence of the strength of Washington fir. The picture gives only a poor idea of the burden carried by the arm.

## A Novel Lightning Arrester

THERE are few lightning arresters which are as simple as the one described in *Popular Electricity* and used by an electric railway and power company in Virginia. It has a 2,200 volt alternating current transmission line running along the road which furnishes current for lighting purposes to private parties in the suburbs. In protecting this line from lightning the



Barbed Wire for Lightning Arrester.

company has strung an ordinary barbed wire, such as is used for fences, on insulators on the extreme tops of the poles, running parallel with the line wire, as shown in the illustration. This barbed wire is then grounded at every other pole. The numerous sharp points on the wire act the same as those on a lightning rod, and gradually "draw off" the static in the atmosphere all along the line. There can be no question as to the efficiency of this method, because the line wires have never been bothered with lightning since this barbed wire "fence" has been put up to keep out undesirable charges of electricity.

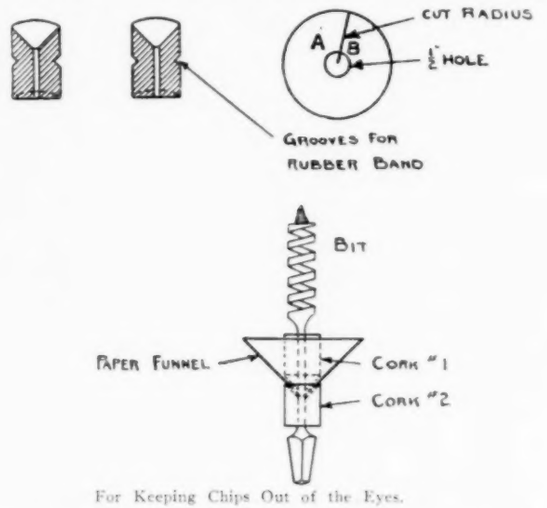
## A Dust Catcher for Borings

A LITTLE device which will be found very serviceable in keeping chips and dirt off the floor and out of the eyes of workmen when ceilings and the like have to be bored was recently described in *Electrocraft*. It is very simple and can easily be made in less time than it takes to describe how to do it.

Take two large corks, about No. 20 or No. 24 in size. In the end of one of these cut a funnel-shaped cavity and cut the end of the other cone shaped, so that the two will fit together quite snugly. Then split each cork carefully down the center. The next step consists in cutting a groove lengthwise down the center of the flat side of each of the split corks. This groove should be just large enough so that the pieces when put together will clamp around the shank of a bit. A small groove should be made around the curved surfaces of the corks, as shown in the diagram.

These grooves are for the rubber bands which must be provided finally to hold the pieces together around the bit shank.

A half-inch hole is then cut in the center of a circular piece of cardboard about twelve inches in diameter, and the cardboard is slit along the radius, as shown in the diagram. Edge *A* is then drawn over edge *B* until a funnel is formed having about the same angle as the funnel-shaped cavity cut in the cork as first described. The cardboard funnel is slipped

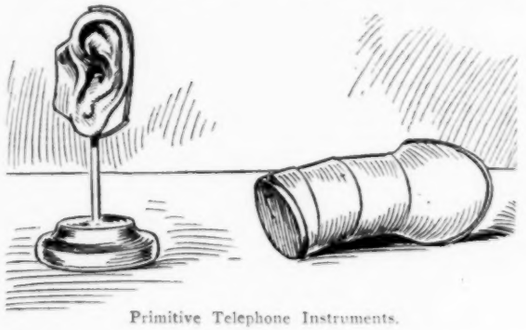



For Keeping Chips Out of the Eyes.

over the shank of the bit, so that the cutting end of the bit will project through the inside of the funnel, some distance beyond its edges. A support for the funnel to hold it in place is formed by clamping the cork having a funnel-shaped cavity in the end around the bit on the outside of the cardboard funnel, while on the inside the cork with the cone-shaped end is similarly attached. Strong rubber bands should be used to hold the pieces of cork together. The appliance assembled is shown in the diagram.

## A Primitive Telephone

ALTHOUGH Alexander Abraham Bell is generally accepted as the inventor of the telephone, the time of the invention being 1876, records show that the same idea was being worked upon by other men prior

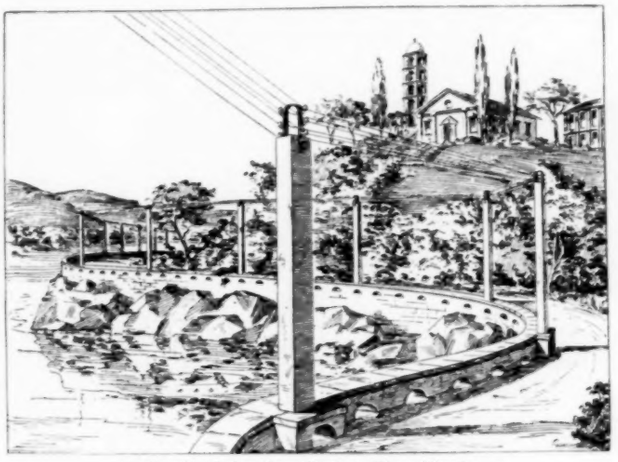


Primitive Telephone Instruments.

to this time. In this latter class we may mention Philip Reis, who, according to *Popular Mechanics,* was busily engaged in trying to solve this problem in the year 1861. The receiver which he designed was especially grewsome, being in the form of a human ear, while his mouthpiece had an end covered with goldbeater's skin.

## Granite Poles in Switzerland

THE great abundance of granite rocks and the lack of timber in the southern part of Switzerland has led to the employment of the former for purposes usually filled by the latter, according to *Popular Mechanics.* Thus, in many sections of the southern country, the fences are of granite instead of wood, the sup-

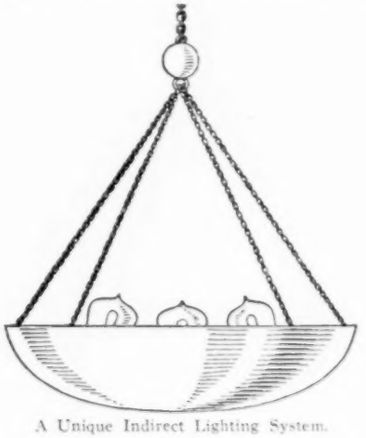


Granite Poles Are Cheaper Than Wood.

ports for the grapevines are granite posts, and pavements, etc., are of granite. Perhaps the most striking departure from the ordinary, however, is the use of granite pillars in place of the usual wooden telegraph, telephone and electric-power transmission poles. Near Lake Como and Lake Maggiore the old highroads originally constructed by the Romans are fringed with granite pillars, 18 feet high, carrying wires.

## A Simple Indirect Lighting Fixture

THE indirect lighting system is deservedly popular. The light which it gives is soft and mellow; there is no glare, and the rays are distributed through-



A Unique Indirect Lighting System.

out the whole room. It is an economical way of lighting, too, for less lights can be used, as it will do away entirely with individual lights on desks or tables.

A unique method of providing an indirect sys-

tem was described in *Popular Mechanics*. The ceiling of the room was painted white, and six electric lights were placed inside of a wooden chopping bowl, two feet in diameter, and suspended from the ceiling. Although no lights are visible, the light reflected from the ceiling illuminates the entire room. The device can be made as ornamental as desired, so as to correspond with any surroundings. It can be hung by heavy bronzed chains, and the bottom of the bowl can be painted, bronzed or gilded.

## Combine Telephone and Lamp

A PATENT has recently been granted to an ingenious inventor who has designed a combined desk telephone and lamp standard. The unique feature lies in the fact that the transmitter is located in the top of the shade, the shade also serving to gather up the sound and concentrate it upon the transmitter.

The Shade Also Gathers Up the Sound.

## A Visit to the Chinese Exchange

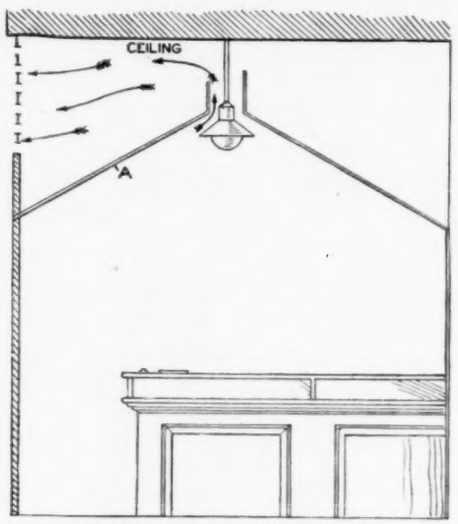
The young ladies of the executive force of the San Francisco Operating School, Pacific Telephone and Telegraph Company, in San Francisco, with a number of their friends and students, were visitors at the Chinese exchange and the Bush Street toll operating room on the evening of October 4. At China office the rich ebony and bronze decorations and the Oriental atmosphere received a delightful appreciation. To many, the surprise of the evening was the Chinese operators, with their smiling English answers to the many questions, and with their deft fingers serving the busy board. The toll room was a mine of interest, with its suggestion of quiet, methodical business. The swift, pneumatic ticket chutes and the precise calculagraphs gave occupation to the entire party in tracing messages from start to finish and watching the constant checking of their progress by machine.

This was the first of many visits which the school instructors have arranged, as not only excursions of interest, but as demonstrations of the broad phases of telephone work throughout the city and its suburbs.

Among countries whose telephone systems are wholly or partly worked by the State, Germany takes the leading place as regards the total of receipts. According to the latest statistics, those for 1909, the aggregate income from the three telephone administrations amounted to $30,685,000. England, which occupied the second place, had a total of only $8,360,000, and France had $8,170,000. The income of no other country reached to as much as $3,800,000.

## A Ventilation Idea

VENTILATING an interior room sometimes becomes a difficult problem. Perhaps the way the occupant of such a room in Chicago solved the difficulty may offer a suggestion to others who have to face this problem.




The Lamp Draws Out the Bad Air.

The room had no outside opening, the air was bad, and was constantly being made more so as people entered the room. To obtain good ventilation the room was fitted with a sub-ceiling, shown as *A* in the diagram, which tapered up to a peak in the center. A large gas lamp was placed in an opening of the peak, so that the heat from the lamp and its consumption of air created a strong upward draft, which pulled the bad air out of the room and exhausted it into the corridor through a perforated ventilating plate. The lamp, of course, is used continuously, regardless of the brightness of the day.

## An Odd Reflector

A CONTRACTOR was working his force of men nights in order to complete a job of installing conduit. In some way, enough reflectors were not furnished, but this omission did not bother the resourceful foreman at all. He procured an ordinary tin basin, punched a hole through the bottom of it just big enough to admit the socket of the lamp, attached the wires, and turned on the current. It took about five minutes to complete the job, and the reflector was as good as anything could be desired.

A Makeshift Reflector.

# What One Woman Thinks

By Sarah Elizabeth Brown

AT this glad season of the year I would like to confine myself to the joyful side of the telephone business, but from the budget of clippings I find before me, the Glooms still have it and the Joys are on the run. I find the ever-recurring word "war." I never see the word "peace." Then how will I see the joyful side of things? Let me think.

I don't recall a Christmas that was ever more kind to me and in contrast I have read reports from many cities which bore down heavily on "A Lean Christmas." Among my friends I find no such complaint. We've had a good year. We have been specially diligent in watching the corners—feeling our way carefully; weighing the smaller problems and sleeping on 'em; taking stock; buying only what was regarded needful and paying for it even more promptly than usual, but that cannot be anything more than a shrewd business policy. The result has made for a condition that is wholly satisfactory. If the year has been lean for middlemen; somewhat thin for the manufacturers and transportation companies it hasn't been altogether bad for the farmers and telephone operators and the nickel shows. As nearly as I can figure it out, a large number of the city folks depend somewhat on bonuses and when the year is bad for employers the bonuses are not forthcoming. The slump affects the laborer who looks for the thing that doesn't come and the cry goes out that it has been "a lean year." The prosperity of this country cannot be judged by anything like that. I dread to read about a "Pitifully Emaciated Santa Claus" when my own stocking overflowed. I would prefer to join the Joy Jumpers than to mingle with the Gloom Goblins.

* * *

And with the same breath I'm glad to learn that the Cuyahoga Telephone Company, without any effort to get business, will close its books on 1911 in better physical and financial condition than ever before. Gross earnings are higher; net is higher and surplus is higher. Having retired $118,000 of 6% notes last May, interest charges are consequently lower and it is said that operating expense will also show substantial reduction. I take a lot of satisfaction in knowing that our own company can report a similar condition.

* * *

It begins to look like the Bell companies of the southern states would get together in one group, operating the whole territory on the unit plan that has spread through the big system. The Cumberland T. & T. Co. at Louisville has been the bone of contention. From present indications the Southern Bell, with headquarters at Atlanta, will dominate the territory south of the Ohio and east of the Mississippi.

* * *

My brother, do you believe in the "survival of the fittest"? Or are you inclined toward the more modern way of putting it—"the survival of the fightenest"? You believe in competition in the telephone business, that is certain. You believed in it before you started your exchange. You promoted your enterprise with competition as the keystone of your plan. You used the other fellows' record as a basis for your argument. You were able to show how it was possible to build your plant; extend it; conserve your prospective investment; do a useful service, and your conclusions were elaborated upon by offering examples of what others had done. You believed in competition in the telephone business.

But do you believe that the old-time threshing outfit—a portable, wood-burning engine drawn by oxen, with its attendant antiquated thresher could move into your community and compete with the modern tractor and its straw-blowing-automatic grain sacker? You do not. It was all right to start your telephone system ten or fifteen years ago and to point out the profits of a similar system that was practically new and prosperous, but you have found that the telephone business, like everything else, must settle down to hard and fast rules. To be a successful competitor you must have attained a dominating stronghold in your community. To accomplish this your rival must be the weaker. After a time you may succeed to the point of eliminating competition and then you will be a monopoly. All the while you are a believer in competition!

There is nothing remarkable about that. The fact is that the natural culmination of competition is monopoly. You can prove it by the book. I am not arguing for a monopoly telephone system. I'm sure that the telephone business of this country can never be managed from a central office of a single system. There are too many obstacles to start naming them. Competition in the telephone business is necessary. It should be encouraged—not stifled; but I greatly deplore the terrible extremes to which competition frequently leads.

* * *

I read a little while ago, Frederick A. Delano's address on "Questions of the Hour." It was an argument upon the attempts of the government to restore competition in business by disintegrating the trusts. Mr. Delano offers an illustration which I want you to read:

> If grocers A and B on the same street cut each other's prices on butter, eggs and other commodities, in spite of the fact that they have come by common experience to know that they can't afford to do it; and, if this ruinous sort of competition is kept up, the ultimate end must be the survival of the fittest. Can Smith and Jones be compelled to compete in spite of their conclusions that it is better to live and let live?

These and many other questions appeal to every man of business, and, indeed, to any thinking citizen. To me it has appeared perfectly


**A Happy New Year!**

*May brightest joys come on your way*
*On this and every future day.*

Sarah Elizabeth Brown

apparent that the competitive system can only operate successfully if the state is ready to protect, in some measure at least, the weaker against the stronger. And, in saying this, I assure you I believe earnestly and heartily in competition as the best spur to any man's intelligence, ingenuity and self-development, but I can't see the sense of a law which says that A, B and C must compete, and yet does not protect B and C from annihilation by reason of the greed or greater business capacity of A. I can't see the sense of a law which says that A, B and C may not combine, and yet, by reason of the complete annihilation of B and C. allows A to survive alone in their stead.

If competition in business was to be a permanent condition, the subject of elimination would not exist. There would be masters; no strength; no weakness. Neither would there be occasion for conferences between Bell and independent operators. Competition pays no attention to weaklings. The battle wages only among the strong. Therefore, I believe in competition —especially in the telephone business, for every system in the land should be strong in its locality, meriting and receiving local support. The factor of long distance is essential, but a telephone company's greatest strength lies in its ability to handle local traffic.

* * *

Clarksville, Tennessee, is the newest town on the map. The Home Telephone Company of that place, with approximately 1,000 instruments, has petitioned the Interstate Commerce Commission to investigate the telephone rates of the American T. & T. Co. The Clarksville Company has put the matter squarely before the Commission which has the power to require the filing of rate schedules. The government officials are showing much interest in the case because there is little doubt that the Clarksville Company attempts to use the commission as a trust-busting agency. Telephone men are expecting extraordinary developments. We all know that this subject of rates is vital and that a rate doesn't always mean what it says.

* * *

The Sunset T. & T. Co. has acquired the Home Telephone Company of Puget Sound with exchanges in Tacoma and Belingham, Wash. The Home Company was capitalized at $5,000,000 and had issued $3,100,000 in bonds. The sale relieves a receiver who has been in charge of the properties for a year and a half. The price paid at public auction was $550,000; $65,705 cash, balance on demand. Before the bondholders are satisfied $30,000 worth of receiver's certificates must be retired. By agreement the receipts of the plants for ten days go to the receiver. There are 5,200 instruments in the two exchanges—3,600 at Tacoma and 1,600 at Belingham. I regret that I am not informed as to the rates, but I am safe in saying that here is another example of bad promotion. Washington's public utility commission will doubtless have a hand in the readjustment. Automatic telephones were employed in both systems.

* * *

Last month I pointed out the deficit in the Manitoba government's telephone system which amounted to $150,000, and flippantly referred to the suggested remedy. They were proposing to double the business rate; establish four-party lines; increase the residence and farmers' rate. Now I hear that all the rates will be raised. The new schedule, business, 1,200 calls $48 and two cents for each additional call takes precedence over the old $50 flat rate. The new residence flat rate is $48; limited to 30 calls per month $1.50 and then two cents per call. Present residence rate is $25 flat. Four-party residence lines will be extended. The new schedule has roused the ire of government patrons, but new schedules have that faculty, no matter what the subject. When rates are not right from any point of view they must be adjusted and Winnipeg is on the right road.

* * *

These state commissioners who are presumed to arbitrate and satisfy the real or imaginary ills of telephone companies are having a busy time of it. In many states there has been no appropriations to cover the ordinary expenses that are sure to arise. In Ohio this handicap of the commission is very extraordinary, for the Winter's act provides nothing beyond the salaries of the commissioners. It is not surprising, then, that physical valuations of telephone properties prior to sale will not be undertaken by the state. The commission will accept the appraisals by the company and attempt to discern fictitious values, should they appear and by that method exercise their prerogative in the matter of rates. The proper way would be to provide the commissioners with a fund from which the engineers might be reimbursed for their expert examinations. Owing to this difficulty the mergers in Ohio do not materialize and competition continues to flourish.

## Edison's Cubic Foot of Copper

Thomas A. Edison made the remark a few months ago that he would like to see a cubic foot of copper. In deference to the wonderful impetus given to the copper industry as a direct result of his inventions, the presidents of a number of the big copper companies decided to gratify this little whim of the great inventor. So they had a cubic foot of copper cast. Half a dozen trials were necessary before a perfect casting was obtained. This was engraved with Edison's name and that of the presidents interested, together with an appreciation from the latter. It was presented to him recently at a dinner at the Waldorf in New York. He remarked that it made the best paper weight he had ever had. It weighed 548 pounds.

## Isles of Shoals Get Telephone Service

A submarine telephone cable has recently been placed in service between the Isles of Shoals, off the coast of New Hampshire, and the mainland. Wireless communication has been maintained across the 10-mile stretch of open sea separating these rocky outposts of civilization from the shore; but the requirements of speed and accuracy led to the demand for telephone connections. Soon after the installation of the cable a wreck occurred on Duck Island, and assistance was summoned from Portsmouth in record time. It is anticipated that the new service will be of the utmost value to summer residents as well as to denizens of the islands.

Medical experts in England who have been investigating the effect of telephone work on the operators have issued a report stating that no evidence was found of injury of any of the special senses. Amæmia and nervous debility are responsible for prolonged absences, but these are the most prevalent complaints among young women in any sedentary occupation. Hysterical attacks are not numerous, and no complaint was made of impaired hearing.

# Problems in Traffic Engineering

By F. P. Valentine*

IT IS the purpose of this paper to deal with a few of the many operating problems that confront a telephone company serving a territory made up of several hundred communities of varying types, ranging from a large metropolitan area to sparsely settled rural districts.

A telephone company has but one line of goods to sell, i. e., service. The entire capital investment in telephone plant and all running expenses are for the purpose of handling the telephone traffic of its subscribers or customers, and from this service is derived the revenue of the company.

Under the prevailing form of telephone operating organization, the responsibility for handling the telephone traffic devolves upon the traffic department, which usually represents about one-half the employees and payroll expense of a telephone company.

In carrying out its duties, the traffic department has a twofold responsibility: first, to the subscribers for the quality of the service that it renders to them; second, to the stockholders and subscribers for the economy with which it renders such service.

The quality of the service is directly dependent upon the effective application of suitable methods of operation. The effective application of suitable methods also bears directly upon the economy, for only by the use of such methods is it possible to obtain the maximum efficiency of force and plant. Further, both the quality and economy of service bear directly upon the satisfaction of the telephone user or customer. The quality should be such as to meet every reasonable requirement; the economy such as to enable the company to supply service to its customers at lowest possible rates compatible with a reasonable return on the investment in order to encourage increase in subscriber development, thus constantly enhancing the value of the service to the individual subscriber.

To meet these requirements it is essential that a traffic department should have, in addition to a proper administrative force, an efficient traffic engineering staff. As the work of this staff is what might be termed the production engineering of the telephone business, it is obvious that it requires a qualitative and quantitative analysis of all factors in any way related to the production of telephone service.

The principal factors entering into the production of telephone service, which must be the subject of engineering study, are as follows:

1. Quality of service.
2. Efficiency of labor.
3. Efficiency of operating methods.
4. Production efficiency of central office equipment.
5. Production efficiency of trunk and toll circuits.

The following discussion of certain phases of traffic engineering problems, in the order above indicated, is based upon some of the results of studies made in the territory of the New England Telephone and Telegraph Company, as it is with the work in this territory that the writer is most familiar. This engineering work, however, is a part of and is carried on in conjunction with that of the engineering staff of the American Telephone and Telegraph Company, for the purpose of making comprehensive fundamental studies.

*A paper presented at the 28th Annual Convention of the American Institute of Electrical Engineers, Chicago, Ill.

## QUALITY OF SERVICE.

From the standpoint of the telephone user, the essential qualities of telephone service are accuracy, speed of connection and uniformity in both speed and methods of handling calls. These requirements are equally essential from the standpoint of the telephone company. Accuracy and speed of connection mean a minimum of waste effort, motion and time. Uniformity in speed and in the method of handling calls trains the telephone user to co-operate with the operator to the same end, with the resultant effect of satisfaction to the telephone user in smooth, speedy service, and for the company a maximum production efficiency by the operating force and an economical use of switchboard equipment.

As the result of constant study there has been developed a systematic method of service inspection which is now practically standardized among the larger operating companies. By means of suitable apparatus, observations are made on every step in the handling of a telephone call. By the use of stop watches the time intervals of each step in the operation are accurately observed and a code record made sufficiently comprehensive to permit the analysis of the tabulated results of these observations. A sufficient number of calls is observed during the hours of regular traffic to insure the results being representative of the general grade of service being given in the office under observation. This service observation is practically continuous in all large exchange districts.

Equally careful analysis is made of the phraseology used by the operator in dealing with the subscriber. This latter is no small factor in accurate and speedy service. A telephone operator has to handle calls from subscribers of all types and characteristics and under all conditions. Every word and phrase used by the operator in dealing with a subscriber is the result of long and careful study and is designed to convey essential and significant information or direction in briefest possible form.

Another record essential to the analysis of service quality is what is termed the "record of service criticisms." This is a record not only of all formal complaints which are received, but also of data collected by all supervising employes in the central offices who have occasion to deal with any subscriber in connection with an abnormal telephone call. The record is made by noting in code, on a proper form, any comments received indicating the fact and nature of any unsatisfactory service that the subscriber has had. Every one of these cases is followed up, and before the record is filed for summarizing, the reasons for the unsatisfactory conditions are entered thereon. Besides affording an opportunity to adjust matters to the satisfaction of the subscribers, the analysis of these criticisms furnishes valuable data as to the most fre-

quent causes of unfavorable opinion of service quality, and affords the opportunity of eliminating or minimizing these causes.

Continuous study and analysis of the results of service observations, together with the data obtained from the record of criticisms, has made possible the adoption of standard operating methods designed to give satisfactory service. All calls of abnormal type involving special handling are transferred to special operators, whose sole duty is to care for this class of traffic. This results in removing the most disturbing elements from the work of the "A" or subscribers' operators, and in providing special attention for such calls on the part of employes especially trained for that work.

The adoption of standard methods of operation and the setting of standards of speed and accuracy has made it possible to reduce all operating procedure to standard sets of instructions for the guidance of all employes concerned. The tabulated results of service observations furnish the administrative force with the information as to how nearly the standards are attained, while the instructions furnish information as to how to attain them.

### EFFICIENCY OF LABOR.

In determining the efficiency of labor, or the production efficiency of an operating force, it is necessary that standards of labor production be established, and that provision be made for significant reports or summaries which will indicate how nearly these standards are approached. It is not sufficient merely to compare results in various exchanges or in the same exchange at different times on the basis of the traffic handled regardless of the conditions attendant upon its handling. Such a comparison assumes to set as a standard the operation in some particular case. It assumes that at some other place or time an operation was performed with greater efficiency, and, therefore, it should be performed here or now at the same efficiency, regardless of whether it is exactly the same proposition in both places or at both times.

The operation of a telephone switchboard comprehends the handling of many different kinds of traffic, and a separate standard is required for the handling of each. To express the degree of efficiency attained as a per cent of these various standards would not only be an interminable task, but would give so many individual results that their study and co-relation would be impracticable.

It is necessary, therefore, that a method be employed which in a single percentage figure will show the degree of efficiency attained. This result is accomplished in the following way:

All calls handled are expressed as though they had been of a single class. This is done by multiplying the number of calls of each class by a factor representing the ratio of the labor of handling the calls of a particular class to the labor of handling calls of the class selected as the unit class.

The standard number of these unit calls which should be handled being determined, the per cent of efficiency is readily obtained by comparing the results obtained with those specified as a standard. From the foregoing it will be seen that this method involves not only the selection of some unit, but the determination of the number of unit calls and the number of calls of other types that may be handled by average skilled operators within a given period, and the establishment of coefficients representing the ratio of the loads of each type of call to that of the unit class.

A flat rate non-trunked call handled on a No. 1 relay board was selected as the unit call for two reasons. It is a very simple type of call and one which predominates in number in most offices. Furthermore, it is of such a class of call that the number an operator can handle depends primarily upon ner ability, and not upon circuit conditions.

The determination of the number of unit calls and the number of calls of other classes that operators could handle involved a most exhaustive study of operating loads. This study consumed a period of over two years, during which many thousands of observations were made, covering all types of calls, normal and abnormal, from all classes of service. As a result of this study it was found that an average skilled operator, working in a team of five or more operators, could carry 230 unit calls per hour and maintain that rate during the entire working day without undue physical or nervous strain, at the same time giving a standard quality of service. Furthermore, it was found that, for a single hour in each half-day period

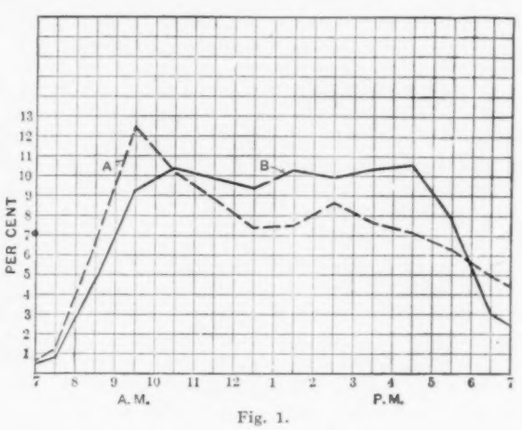



Fig. 1.

an operator could, without material impairment of the service, handle 25 per cent more than this number. Even this load could be exceeded at times of unusually sharp peaks.

The ability of the force to carry the peaks at loads in excess of the average busy hour loads is an important factor in determining operating force requirements. Fig. 1 shows in percentages the actual distribution of traffic in two offices for the day hours. The curve marked *A* is that of an office of the best type of residential subscribers, while the curve marked *B* is that of an exclusively business office. The operators at *A* can carry the busy hour traffic at loads exceeding those of the average busy hours, while the operators at *B* will carry the standard load. With an equal amount of daily traffic in both offices, the same number of operators will handle the busy hour traffic of *A* as are required to handle the busy hour traffic of *B*.

In the evolution of this system of equating calls covering two years of exhaustive study and some four years of practical application, its value and accuracy have been thoroughly tested. Its value lies not only in the fact that it furnishes a means of measuring the efficiency of labor, and is essential in measuring the efficiency of some of the other four factors mentioned

in opening this discussion, but in the fact that it has opened the way to a most exhaustive analytical study of the human element upon which telephone operation is so dependent.

As a result of the establishment of standards of service quality and labor efficiency, it has been possible to institute methods of selecting and training an operating force with a degree of success otherwise impossible. The question of fitness is of primary importance, and the matter of intelligent selection of operators is the result of many years of careful study of the qualities essential to success. All accepted candidates for operating positions are required to spend one month in the operators' training school listening to lectures in regard to the handling of all types of calls, with the necessary study and examination hours, and in practical operating work under capable instructors on a regular working switchboard, representing a typical central office, the calls being originated by instructors. No operator is allowed to work at a central office and handle the calls of telephone users until she has graduated from the school course and met a certain standard of requirement. With this training she has a thorough knowledge of how all classes of calls should be handled and only needs experience to settle that knowledge and acquire speed. This same course of training in modified form is carried on in the smaller central offices, where it is not economical to maintain a regular operators' school.

On an average it takes about a year for an operator to attain maximum efficiency. In view of the fact that, as in any large body of employees, there are constantly resignations and occasionally dismissals for cause, together with the steady growth in subscribers and traffic, it is obvious that the problem of maintaining at all times an adequate and suitably trained operating force is a very important one. On account of the reasons enumerated, it has been found that in order to produce a force of one year's average experience it has been necessary to start and partially train, or train and keep in service for a short period only, at least three for every one who stayed a year. As it costs over $200,000 per year to train central office operators in the territory of the New England Telephone and Telegraph Company, it is obvious that this is a problem well worthy of careful study.

In order to meet this problem, all conditions of employment and work have received most critical analysis. The operating loads have been most carefully determined, having in mind the physical well being of an operating force. Working conditions have been made as pleasant and comfortable as possible. In addition to a liberal lunch hour, a fifteen-minute relief period is insisted upon in the midst of each half-day period. Commodious and tastefully furnished rest rooms are provided, magazines and periodicals supplied, and everything possible done to make the work attractive and free from excessive nervous strain. Vacations, with pay, are allowed once during each calendar year. To further the careful study of working conditions and of the human element as it enters into the problem, for over two years the New England Company has employed a physician of highest standing to make a special study of all phases of these conditions.

A careful record is kept of each employee from the time she enters the service of the company to the time she leaves. This record shows the character of the employee's work, comments on her superiors, results of service observations, and every detail that has a bearing on her efficiency. Such a record is essential in the determination of proper wage increases, and the record of reasons for resignation or dismissal is of especial value in the study of ways and means of maintaining a stable operating force.

This carefully studied system of selection, training and caring for employees, with adequate compensation for efficient work, based solely on merit, has had good results, as is indicated by the fact that during the past four years, it has been possible to increase the average length of employment of the operating forces by 20 per cent, while there is always a waiting list from which to select candidates. It would seem obvious, therefore, that as a large factor in the efficiency of labor the study of the development and maintenance of a proper operating force is essential.

### EFFICIENCY OF OPERATING METHODS.

The efficiency of operating methods is in their adaptability to produce the required quality of service with the minimum of effort, labor and operating time per call, together with an economical use of switchboards, trunk and toll circuits.

The methods of handling local calls have been fairly uniform for a number of years, the greatest improvements having been made in specializing the operation for irregular calls, or those which cannot be completed at once by the *A* or subscriber's operator. Another step toward the application of efficient operating methods, brought about by the careful study of recent years, is the gradual elimination or diminution of abnormal types of service, such as heavily loaded party lines in congested centers, etc., which tend to degrade the quality and economy of service.

In the field of toll service, except in a few notable instances, progress was not as great up until comparatively recently. Toll services must be considered in two classes—"short-haul," or suburban toll, and "long-haul," or "long distance" toll. Within a comparatively short radius of most large telephonic centers are usually found a number of smaller communities closely related to the large center and with each other in a business and social way. The telephone traffic between such offices is of the class first mentioned and usually constitutes a very substantial portion of the toll business, the traffic to more distant points, covered by the second class mentioned, being in the minority.

Toll operating methods have been the subject of most critical analysis for the past few years, resulting in the standardization of several different types of toll operation, each designed to be applied under given conditions.

The subject of operating methods is so fundamental to efficient operation in all its phases that it has received and is receiving very comprehensive study. Every suggestion must receive most careful and critical consideration in order to detect any inherent weakness and to guard against the introduction of a method which, while apparently harmless and even efficient under existing conditions, might fail to meet the requirements of a constantly increasing traffic.

So far as concerns the production efficiency of various operating methods, the use of the unit system, hereinbefore outlined, provided a means of determin-

ing the relative efficiency of the different methods. The effect of any change from one method to another can be predetermined by the application of the proper coefficients to the traffic involved.

PRODUCTION EFFICIENCY OF CENTRAL OFFICE EQUIPMENT.

The amount of central office equipment necessary is directly dependent upon the number of equated or unit calls to be handled during the average busy hours, or, in other words, upon the number of employees for whom it is necessary to provide switchboard positions during the average busy hours. With service of standard quality, labor production at standard efficiency, and efficient operating methods, by use of the unit system applied to the amount of traffic to be handled, the switchboard requirements can be accurately determined. The discussion of operators' loads and Fig. 1 in the preceding section apply also to the determination of amount of switchboard.

In engineering central office equipment it is customary to engineer on a basis of a fifteen to twenty year ultimate capacity and to install initial equipment sufficient to cover from two and one-half to three years' growth. As it is necessary to know the ultimate requirements for buildings, etc., these are developed through special studies or "fundamental plans" which include the consideration of all factors that have a bearing on the future development. In order to determine the probable growth in subscribers, it is necessary to maintain curves of growth for past years for each class of service sold. These curves are projected to the ultimate period, and corrected periodically from actual growth. With the curves of station growth is maintained a curve of the station calling rate in each class of service. From these records, supplemented by the yearly estimates of growth, can be determined the number of stations, and volume and type of traffic to be expected at any future period. By application of equating process to the various classes of traffic and obtaining the number of unit calls to be handled, it is possible to forecast accurately the amount of switchboard required.

The production efficiency of central office equipment is determined by the output per position, or per dollar of investment. The unit system furnishes means of determining the relative efficiency of different types of switchboard for handling particular classes of service under given conditions. Given the desired standard quality of service, the production capacity of a given switchboard unit of any type can be predetermined, and actual results attained can be checked, by the proper use of the unit system. The relative economy of different types of boards must be balanced against other costs incidental to the case under consideration.

PRODUCTION EFFICIENCY OF TRUNK AND TOLL CIRCUITS.

The production efficiency of trunk and toll circuits is affected by the quality of service which it is desired to produce, by the efficiency of operating labor, and by the efficiency of operating methods, and to a certain degree, by the efficiency of central office equipment. It is also affected by the volume of traffic to be handled and the contract conditions under which the service is sold.

Analysis of this subject has demonstrated that while operating and equipment costs vary directly with the number of unit calls, circuit costs vary indirectly with the number of calls, due to the varying efficiency of circuits in groups of different sizes, and more or less directly with the length of haul under a given amount of traffic, except so far as qualified by variation in type of plant necessary to meet transmission requirements.

The production capacity of a circuit under any method of operation, is determined by the average circuit holding time per call and the number of calls to be handled over the particular group of circuits in a given time.

For proper consideration of the subject of circuits, distinction will be made between trunk and toll circuits. Trunk circuits may be considered as local circuits connecting offices covering an area of too great telephonic density to be served economically from one central office, and in which case local service, so called, is sold covering intercommunication between the several central offices. Toll circuits will be defined as circuits between offices more distant from each other and between which the service is sold on a message basis, the charge being graded according to duration of connection and distance involved.

Toll circuits, however, must be considered in two classes, one embracing the "short-haul" or suburban toll traffic, and the other the "long-haul" or "long-distance" traffic. The former class may be considered on the same basis as trunk circuits, so far as concerns production efficiency and engineering.

The trunk circuits and "short-haul" toll circuits are provided for the purpose of handling calls on a local basis; that is, the telephone subscriber passes the desired number to his operator and remains at the telephone until the connection is completed or a report returned to him of inability to complete. This feature of the trunk and "short-haul" toll operation necessitates providing a sufficient number of circuits between two offices to handle the traffic offered during the busiest period so that there is always a circuit available when a call is to be handled.

The "long-haul" circuits are for economical reasons provided on a less liberal basis which contemplates that the calls will not be handled while the subscriber remains at his telephone.

A comprehensive series of studies on the subject of circuit use has resulted in the development of methods by the use of which all the elements entering into circuit use can be given proper consideration, and the most efficient operating methods applied to existing conditions.

In figuring circuit loads, as a matter of convenience it is usual to consider the load for a given group of circuits, rather than for a single circuit. As the circuit holding time is made up the time of conversation plus the use of the line for operating purposes, the total holding time for a call will differ according to the operating method used; for example, the local or "short-haul" toll requires less holding time than that handled on the "long-haul" basis. Also the efficiency of the individual circuits increases as the size of the group increases. These various factors have been studied and reduced to known quantities.

Having ascertained the production capacity of circuits under various conditions of volume of traffic and methods of operation, it is possible to set the proper standards to apply, and with which to check actual results, so far as concerns individual groups

of circuits. In considering the circuit efficiency between two offices, as these same circuits may carry in addition the traffic to other points, the plant must be considered as a whole. The comprehensive study which has been referred to has developed methods by which the circuit plant can be intelligently laid out with predetermined results. The problem in laying out a circuit plant is to furnish the proper standard of service as to accuracy, speed and transmission, with a minimum investment in line plant. It is obvious when one considers the variety of types and grades of trunks and toll circuits that this is no small matter.

The production efficiency of a trunk and toll circuit plant has usually been figured either by computing the number of calls handled per circuit or the earnings per circuit mile. Neither of these methods, however, gives the true measure of circuit production efficiency, inasmuch as for economical reasons it is often necessary to switch long-haul calls through one or more intermediate offices, and on account of the varying size of circuit groups and the consequent variation in the capacity of individual circuits, the real production efficiency of the circuits cannot thus readily be determined. On the other hand, comparison of the earnings per circuit mile would be very misleading if any change in rates had been made between the periods under consideration.

A far more logical means of measuring the production efficiency of a trunk and toll circuit plant is afforded by computing the number of message miles produced per circuit mile. By computing the former on a basis of air line measurements between points of connection and the latter on the basis of actual circuit route mileage, a means is afforded of checking the efficiency of circuit plant layout, not only from the standpoint of the efficiency of labor and methods, but also from the standpoint of economical plant layout. *(To be Continued.)*

# A Cure for Telephone Incivility

By E. A. J. Seddon

UNFORTUNATELY it is a very common trait of human nature to undervalue the commonplace. As the old saying goes, "Familiarity breeds contempt." In this day of rapid progress, wonderful inventions are developed, applied industrially or commercially, and then presented to the public, who are at first startled into admiration and then accept all as a matter of course.

The telephone industry in this country ranks with the leaders in the matter of development until it has becomes almost a household necessity, and most emphatically a business necessity. There is hardly a householder of moderate means who has not a telephone in his home, and the person who does not use a telephone is unknown.

Yet, with this great convenience within the reach of every one, and its benefits shared by all, its privileges are much abused and discourteous treatment over the telephone is by no means uncommon. In fact, telephone discourtesy and incivility call for more than a passing comment.

Before attempting to suggest any remedy for this annoyance it would be well to look into some of the possible excuses, or, to stretch a point, possible causes, for discourtesy, as it is necessary to discover the cause before the evil can be remedied.

A very large per cent of telephone discourtesy is due to just plain thoughtlessness—perhaps it would be more correct to say ignorance of how a telephone should be used. Outside of the telephone fraternity there are few people who really know how a telephone connection is established, and because of this they are frequently guilty of little acts of discourtesy; but these as a rule, are seldom serious. The most annoying of such offenders is the "Johnnie Wise" clerk or office boy who takes his own sweet time in answering a telephone call, and, when he does, jerks the desk set towards him by the cord, yanks the receiver off the hook, holds the set in his lap, over his shoulder or upside down—it's immaterial to him, since such insignificant details as talking over a telephone are beneath his notice—and bawls out "Wa-all," talks into the air, says "Yep" and "Nope" and "Dunno" and slams up the receiver when he thinks the conversation is ended, and wonders why it is the other fellow doesn't hear him. Such a method of using a telephone is common enough—in fact, altogether too common—and is the source of service complaints to the telephone company.

A very common form of discourtesy is failure to answer a telephone call promptly; another is for the subscriber to abuse the operator for reporting a line "Busy" or "Don't answer"; and still another is when a subscriber calls for a wrong number and hangs up after discovering his mistake and before the other station answers, thus leaving the impression that it was the operator's fault. Leaving the telephone to hunt up information, without notifying the party at the other end of the line, and keeping him waiting unnecessarily, is another source of annoyance and trouble.

As stated before, many of these annoyances are due to thoughtlessness; the offenders really mean no harm and have no idea of being discourteous, and yet if they were confronted by the people in person their manner would usually be different.

In society it is easy enough to be courteous, because that is the proper thing to be, but in the privacy of one's own room, office or telephone booth people will show their breeding because they are themselves. A courteous man or woman is courteous under all circumstances—at home, abroad, in business, in society and over the telephone. The other kind of person may be courteous in society, and sometimes in business, but he is himself when it comes to using the telephone.

People will show the cloven hoof while using the telephone quicker than almost any other way, and the cowardly soul loves to bluster and bulldoze over the telephone—it's so safe.

The causes of telephone discourtesy could be analyzed still further, but enough has been hinted at to give the characteristic difficulties of the problem—a problem as complex as human nature, and that being

the case there is no complete solution. It resolves itself into the task of educating the public into the proper use of the telephone.

As a general thing the public responds when an effort is being made to improve conditions. Telephone companies are rapidly bringing their operating forces to a high degree of efficiency—each year sees more attention paid to the apparently simple matter of establishing a connection between two subscribers in a satisfactory manner. The discipline of a modern operating room is excellent and discourtesy is practically unknown, which could not be said of some of the earlier exchanges.

Since the operator comes in contact with the public more often than any other employee, a large share of this problem falls upon her. The influence an operator has upon her subscribers is very marked. The medium of an operator's influence is her voice. It is possible for an operator, without violating any rules of the operating room, to use a tone of voice that is aggravating to a subscriber and provokes him to incivility. An operator's voice should be pleasant, businesslike and interested, indicating that she wishes to establish a satisfactory connection for that particular number calling. The same care should be exercised in reporting a busy line or a "Don't answer." Here again the voice should be pleasant and businesslike, with a confident tone. A flat, lifeless, disinterested voice has often provoked the uncivil remark "What's the matter, why don't you wake up," and put the subscriber in a bad frame of mind, as well as the operator. It often happens that those in charge of the operating department can take a discourteous person in hand and diplomatically direct him into the paths of common telephone courtesy.

The detail of voice inflection is of great importance, since the telephone company is in closer touch with the public through the medium of the voice, than any other public service corporation, and yet it is a detail that is sadly overlooked. There is a great field for missionary work in this one little detail. The business office, trouble department and line men, as well as the operating department, can all co-operate and do much to remedy this annoyance.

Every telephone employee should be required to use a telephone properly. This might seem a needless suggestion to make, but an investigation would prove interesting and bring to light some facts that are not usually known. This is another matter of detail that is generally overlooked. However, it is a detail of much importance, since it carries with it the force of example—people will naturally notice how telephone officials and employees use the telephone and unconsciously imitate them. The telephone business and work is essentially a matter of detail and it is attention to detail that counts.

The telephone directory is an excellent advertising medium and a sure way of reaching the people. A campaign for common courtesy can be carried on through its pages. In many directories you will find—if you look for it—several paragraphs of closely set type and headed "Suggestions to Subscribers," or some similar title. Now the suggestions may be excellent, but people will not read closely set type if they can avoid it. If they do take that trouble, so many suggestions have been offered that they do not retain any of them. The merchant who undertakes to sell some splendid bargains and advertised them in solid nonpareil would vehemently declare that advertising does not pay; therefore, the suggestions should be made as attractive as possible. They should be designed to be read—just as much so as an expensive advertisement—and changed as often as new ideas occur. Do not these stereotyped suggestions occupy valuable advertising space? Why fill it with dead reading matter?

To promote common telephone courtesy a few separate hints well displayed will sow seed that cannot help but be fruitful. For instance:

Mr. Merchant: Have you ever noticed how your clerks answer your telephone?

*"COURTESY IS A VALUABLE BUSINESS ASSET."*

Mr. Business-Man: Do you know it is a fact that the average person will wait only from 40 to 50 seconds for the telephone he is calling to answer?

Is your telephone answered promptly?

*"COURTESY IS A VALUABLE BUSINESS ASSET."*

It is our desire to give the best service possible. We ask your cheerful co-operation.

*"COURTESY IS A VALUABLE BUSINESS ASSET."*

The hints could be attractive typographically, with a border around them—a border made up of desk sets with wall sets for corner pieces would be effective. An outline sketch illustrating the hint drives the point home more emphatically; it will be surely read—attractive, short, illustrated.

There are several thousand telephone employees throughout the country, and a systematic campaign carried out along the lines as outlined could not but be effective.

## Ohio Companies Have Taxes Increased

Reporting the valuation of more than 600 telephone plants doing business in Ohio, the Tax Commission has fixed the amount of money invested in this class of property at $60,914,429. Aside from being assessed for taxation purposes by the Tax Commission this enormous investment has been placed under the supervision of the Public Service Commission of the state, and that body must supervise any merging of the 600 companies that may be contemplated.

The report of the Tax Commission shows that the valuation of telephone properties has been increased two and a half times over the value placed on them last year by the commission itself. At that time an effort was made to get them on for 60 per cent of their actual value, but further inspection of more systematic reports this year shows an increase from $21,798,580 to $60,914,420.

Before the Tax Commission assumed jurisdiction over telephone companies last year, they were valued for taxation by the State Board of Assessors and Appraisers, who left the real work of placing the values with the department of the Auditor of State, who is a member of the board.

While this system was in vogue the telephone companies were valued at $15,551,398, and this value prevailed until 1909, when the Tax Commission took hold of the work. The Tax Commsision's valuation shows that it has increased the value of telephone property in the state 300 per cent in two years, and that this class of property has consequently been brought to bear a greater share of the total burden of taxation than ever before.

# Digest of Foreign Telephone Literature

## Translated for Our Readers

THE COPENHAGEN TELEPHONE SYSTEM.

COPENHAGEN has made more progress in its telephone system than any other European city. With its 500,000 inhabitants it has as many telephone exchanges as Hamburg, which is twice as large. Paris, with its 2,500,000 inhabitants has only 45,000 lines, while Copenhagen has 31,000 lines. Its development and progress is probably of greatest interest among all the European cities.

*Use of Telephones.*—While the number of subscribers has grown from 19,000 to 31,000 within a period of five years, the proportion of calls for the different subscribers has decreased from 9.1 to 8.2. This applies, however, only to private subscribers and party lines. While these people have telephones in their homes, they make comparatively little use of them. On the other hand we find that the number of calls for large subscribers like business concerns has increased enormously. The distribution of calls among the subscribers is seen from the following table:

| No. of Calls per Year. | Per Cent of Subscribers. | Per Cent of Calls. |
|---|---|---|
| Below 1,000 | 33 | 10 |
| 1,000 to 2,000 | 33 | 20 |
| 2,000 to 4,000 | 18 | 20 |
| Above 4,000 | 16 | 50 |
| | 100 | 100 |

This scale shows how little real information a table of averages can give. There is a vast difference in real practice between the third of the subscribers who make one-tenth of the calls, and the sixth who make one-half of all the city calls. This important difference between "small" and "large" subscribers is the basis for the installation of the telephone system. The plans were made in 1905, and experience has proved them to be correct. The small subscriber demands the lowest rate possible and the least expensive equipment. With the small number of calls it makes little difference, if the rate per call is a little higher.

For the large subscriber with thousands of calls per year, the operating costs are of greatest importance. To obtain a low rate per call, and rapid service, it pays to install first class, costly equipment for the large subscriber.

*Equipment for Small Subscribers:* 1. *Short Lines.*—The city has been divided into medium sized districts of about 3 km. diameter, containing about 6,000 subscribers each.

2. *Small Conductors.*—The telephone cable conductors can under these conditions be made as small as possible. The standard has been set at 0.5 mm. and up to 700 double conductors in each cable.

3. *Party Lines.*—A small subscriber uses his line only for a very short time, and it is therefore possible to serve 2, 3, and 4 subscribers over one line. When a subscriber of the exchange in question calls up the latter, or is called, the line must be arranged in such a way that the other subscribers are not called. In Copenhagen, the four party lines are used in flats of three or more stories only, while two party lines are used everywhere else, except in the suburbs.

4. *Privacy.*—If the simplest and cheapest party line system is used, we have the diaagreeable fact that other parties can listen to the calling subscriber. There is therefore no privacy. Objections have been made against the above drawback, but to no avail, as privacy would mean the installation of a more expensive system, which few, if any, care to pay for. In Copenhagen a two-party connection with 2,000 calls a year costs $17.50, whereas, a private single wire costs $25 a year. The small subscriber, as a rule, prefers the $17.50 to the $25 rate, and is resigned to the lack of privacy. There are about 12,500 party lines at the present time, and only 8,000 small one-line subscribers. Complaints of listening and disturbances by other members of the party lines are very rare, being hardly one per cent per year of the total number of subscribers.

5. *Simplification of Exchange.*—Only about 10 to 15 per cent of the local calls received at the various district exchanges are calls between two subscribers of the same exchange. It is therefore too expensive for such a small number of calls to install a multiple panel for the "A" operators at the exchange, where the call lamps of the subscribers are found. Such a multiple switchboard is only necessary for the "B" operators,

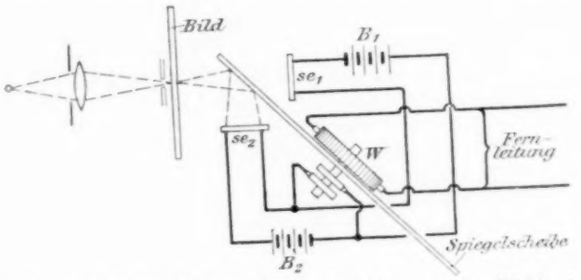



Fig. 1. Transmitting Station with Two Selenium Cells, Which Are Lighted Alternately Through a Disc with Openings.

where the calls coming into the exchange are sent to the right switchboard. This has led to a considerable saving in installing exchanges.

6. *Junction Lines.*—The rate paid by the subscriber when starting service embraces only the parts of the equipment devoted to his permanent personal use, as telephones, his line, and his call number at the exchange. The trunk lines connecting the various exchanges with each other are used by all of the subscribers, and the costs of the same must be figured in the rates per call. The same applies to the maintenance costs of the "B" operators' instruments.

While it is possible to reduce the size of the subscribers' lines to a minimum, this is not the case with the trunk cables between exchanges, as such a proceeding would result in indistinct calls. This part of the work is often not treated as carefully by telephone companies as it should be and has often cost more than it really should have cost if conditions were considered more.

*Equipment for Large Subscribers:* 1. *Service.*—The most important problem here is that of rapid connections. Since large subscribers usually deal with other

large subscribers, it is good policy to connect as many of these as possible to one exchange. In Copenhagen all of the subscribers with a large number of calls are connected to the central exchange. Each call between these subscribers can therefore be handled by one operator, giving quick and economical service. About 30 per cent of the large subscribers are connected with the central exchange, but about 70 per cent of their calls are local, so that only 30 per cent require trunk lines.

2. *Telephone Lines.*—The lines of the large subscribers are conducted in the same cables with the small subscribers' lines. At the district exchanges so-called distributing cables have been installed, and from these the various subscribers' lines are led in separate cables to the central exchange. These cables are of the same dimensions as those between exchanges.

3. *Limit of Calls.*—The reply "busy wire" is of comparatively little importance to the small subscriber. If we take a maximum number of 4,000 calls for these subscribers in each direction, *i. e.*, back and forth between exchange and subscriber, we find that the line in question is busy in about 10 per cent of all calls. For the large subscribers the "busy wire" return is of greater importance. A subscriber with 8,000 outgoing calls will have at least 16,000 calls on his lines, which corresponds to a "busy wire" percentage of 22 per cent. If we add the repeated calls, when wires are still busy, the "busy" percentage may rise to 28 per cent, which is equal to 2,200 calls a year. With a rate of $0.25 per 100 connections, we have extra costs of about $5.20 a year for frequent busy wires. It is therefore necessary from the standpoint of service and costs to consider 8,000 calls the maximum for a subscriber who has only one line. The rates are based on the calls made by the subscriber. But in determining the necessary number of lines it would be better to go out from the standpoint of "busy wires," which could be easily determined by watching calls for a certain number of days. This is done by the Copenhagen exchange, and subscribers gladly install several trunk lines, when they see that their existing lines are too busy in proportion to the calls received and not answered by reason of "busy lines."

4. *Auxiliary System.*—The double cord system used makes it desirable to have the power of relieving operators in rush hours by means of an auxiliary system. In the Johannsen system, which is used, the operator connects the subscriber, whose call she cannot answer with another operator at the same switchboard whose lines are not busy at the time. This avoids the necessity of an extra switchboard. The Christensen automatic selector is used at these exchanges. The operator has three cords, each having a selector. When one or two subscribers wait for an answer, and are joined by a third one, the operator uses one of the selector cords to connect the last subscriber with an idle operator's line.

The auxiliary system, used as an experiment during one year, was used in a 3,000-subscribers' exchange and gave excellent results. The effect of the system was noted, when it was discontinued for a short time so as to study the difference in operation. An increased waiting time of subscribers and rapid fatigue of the operators was the immediate result. The efficiency of the operators has been increased by this system from 0.4 to 0.5, with decreased operating costs of 10 to 20 per cent.

5. *Rates.*—The rates are figured separate for each system, based on the operating and maintenance costs, and are as follows:

1. Four-party systems (only in large apartments within the city limits), flat rates per year $7.50 and 3c per call.

2. Two-party line system, per year, $17; 2,000 calls free; if this number is exceeded, two private lines must be installed.

3. Thousand call systems, per year, $20; 1,200 calls free; $5 added for any ratio of 1,000 additional calls.

4. Business connection at central exchange, per year, $31; 5,500 calls free, and up to 8,000 calls per year $40.

The subscribers (1909) were distributed as follows:

| | Subscribers. |
|---|---|
| Central Exchange | 9,500 |
| District Exchanges— | |
| Private lines | 8,000 |
| Two-party line systems | 11,000 |
| Four-party line systems | 1,600 |
| Automatic instruments, booths, public stations | 800—21,400 |
| Total | 30,900 |

6. *Counting of Calls.*—The above rates do not necessitate an exact counting of calls, except with the four-party lines, where each subscriber has a Veeder counter, which registers each call when the receiver is lifted from the hook. From the total amount 33 per cent is deducted to allow for busy wires, wrong connections, interruptions, etc.

The Copenhagen telegraph system has been very successful and economical and demonstrates the economy of operation, provided careful study is made of local conditions and the proper equipment is used.—*Elektrotechnische Zeitschrift.*

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### A SYSTEM TO ELIMINATE THE EFFECTS OF INERTIA IN SELENIUM CELLS.

It is known that rapid radiations in the illumination of selenium cells are reproduced in the current fluctuations caused by their change in resistance; so that they can be used in telephotography, where the absolute amount of current and its gradual change are not expressed. Telephotography has therefore adopted

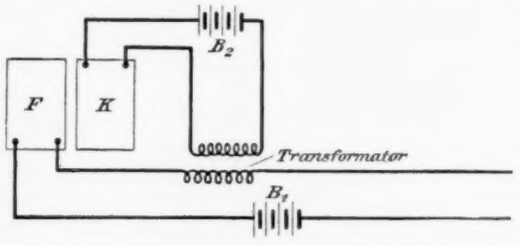


Fig. 2.—Use of Two Selenium Cells. The Transformed Current of Cell K Influences the Current from Cell F and Relieves the Contrasts.

the system of intermittent illumination of the selenium cells, instead of constant illumination, and has set a commutator upon the light-interrupting disc, which acts as a sort of "rectifier" of the current variations. This changes the battery current, however, into a. c., so that it is possible to avoid any difficulties which might arise due to the use of a d. c. instrument at the receiving station.

As there is no advantage in sending a large inactive current through the receiving instrument, it is tried to reduce this as much as possible, and several means are used for this purpose. The simplest is to transform the selenium cell current by means of an induction coil, and only rectify the secondary current of the coil.

If the intention is to light two cells alternately, having one pencil of light rays, of the breadth of a single cell, it is necessary to substitute a plate glass disc for the light interrupting disc (Fig. 1). This

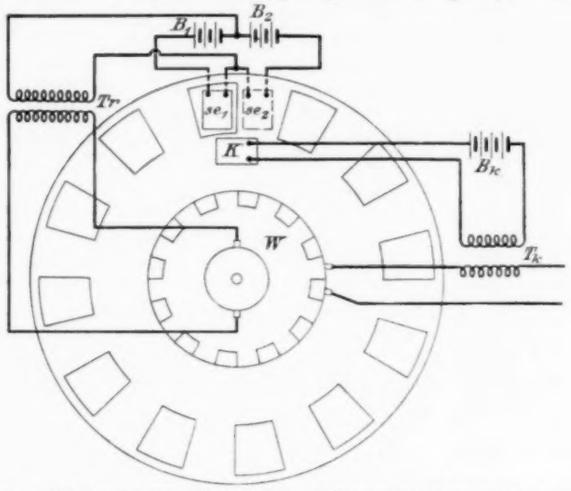


Fig. 3. Sender with Two Alternately, and One Constantly Lighted Selenium Cell, Which Later Relieves the Contrasts.

glass disc is provided with openings and works in such a way that during rotation it allows the light to pass and strike the one selenium cell in one position, reflecting this light and throwing it upon the other selenium cell by means of the glass disc in the other position.

Another method is by having the selenium cells from two independent current circuits (Fig. 2). The two cells are to be influenced by the light rays at the same time. The correction or rectifying cell should have a greater inertia than the "light struck cell," so that the same can send current into the long-distance lines, even after change of lighting effect. Its sensitiveness must be high, however, and two equally powerful cells ought to be used, placing a green light screen in front of the so-called "feeling cell" and a red screen before the rectifying cell.

When using a single selenium cell, when its current is sent directly into the receiving station, the contrasts in images suffer especially through the inertia of the cell, and a correction or rectifying cell is best used for this trouble. Fig. 3 shows such an arrangement. This cell is, however, not lighted at intervals, but set in front of the rotating disc.

Tests with the three systems of selenium cell arrangements gave satisfactory results.

One of the effects of intermittent lighting of cells was the fact that the frequency of light interruption must be increased in proportion to the accuracy of transmission and the shortness of its duration. The higher the number of periods of light interruptions, the stronger must be the light thrown upon the cells, which applies especially to the case in which the cell current is directly rectified without preliminary transforming. —*Elektrotechnische Zeitschrift.*

## White Ants and Telephone Cables

Among the troubles which maintenance engineers have to face in other parts of the world, we may mention the affinity which the white ants of Australia seem to have for cables. In one case near Adelaide it has been necessary to remove a section of a telephone cable, the condition of which leaves little reason to doubt that white ants have eaten away both the lead covering and the insulation. The cable in question consists of 100 pairs of paper-covered wires. Similar troubles have occurred on the cables supplying energy to the Sydney tramways. These cables were laid on the solid system. The ants, however, got through the bitumen compound and then attacked the lead sheathing, finally eating into the insulation of the high-tension cables. The authorities thereupon decided it was necessary to provide poison for the termites, and the bitumen in which the cables were laid was, therefore, mixed with half an ounce of arsenious oxide to a cubic foot of bitumen. The same procedure was followed at Adelaide, where a specially strong mixture, consisting of half a pound of arsenious oxide per cubic foot of bitumen, was also run in a thin layer along the top of the trough after the main bulk of the bitumen had cooled off. The ants appear to work very quickly, for cases have occurred in the main street of Adelaide where the Jarrah wood blocks (supposed to be white-ant proof) that are laid between the tramway tracks have been absolutely riddled in 2½ years.

## Few Telephones in London Exhibition

The English telephone manufacturers evidently need waking up. At the electrical exhibition recently held in London, telephone exhibits were conspicuous by their absence, and this was in spite of the fact that the exhibition was intended to cover every branch of the electrical art. One of the British journals comments upon this state of affairs as follows:

> Telephone exhibits, with one exception, were disappointing. One of the best-known firms contented itself with a profuse display of dry batteries, whilst another, which is only just entering upon this branch of the industry, pushed its wares into an odd corner where they had to take their chance of being seen at all. Again, having regard to the projected trial of automatic telephony by the British Post Office, one would have expected at least one 100-line unit to be on view at Olympia, but the only example of automatic exchange equipment was a comparatively unknown system of Continental origin, hidden away in the corner of a gallery stand.

## Christmas Entertainment by Telephone

The old ladies of the Denver Old Ladies' Home were able to enjoy the Christmas concert at the Auditorium on Sunday, December 24th, and it was not necessary for them to brave any inclemencies of the weather, either. This was made possible by The Mountain State Telephone and Telegraph Company, working in conjunction with the General Acousticon Company.

The Auditorium was wired by the telephone company so that for the Christmas concert an acousticon was installed. This took up the music of the band and transmitted it over a telephone circuit to the Old Ladies' Home where it was reproduced in the Assembly Hall through a large horn similar to the horn of a phonograph.

# Keeping Track of Operating Costs

By Percy Redmund*

GOOD management means good service with minimum expense. It does not require any great amount of brains to get results if there is no regard for the cost. It does not take a clever head to operate at low cost, or to reduce expenses, if poor service is allowed; but to continue getting a satisfactory standard of service at the lowest possible cost does require what is called executive ability. Most of the telephone companies today make it the chief operator's duty to give "standard service at a minimum cost." That is quite a good-sized job for any operating woman, and too often she is not given the necessary information and coaching.

Some have contended that "standard service at a minimum cost" is too big and broad a problem to put up to a chief operator, but it is not. If it is placed in simple, concise form, it will be found that in the ranks of operators and supervisors there are many good, clever heads who can balance the features of "service" and "cost" just as easily as they can consider, together, the various features of service.

The chief operator promoted from the ranks has an appreciation for service born of her constant work with it as an operator, while cost is a matter which, as an operator, she was not called upon to consider; therefore, she must be taught the cost side of her job. She must have cost statements showing what the pay roll expense of her office is. If a chief operator makes up her own pay roll she has all the important information from which to compile figures by which she can watch expenses. The expenses of local operating and toll operating should be separated. If an employe does both local and toll operating, as is sometimes the case in a small office, the expense of her salary should be divided, according to the division of her actual time, between the two classes of work. If the chief operator does not complete the pay roll these figures must, and can be, obtained from the general office.

The figure shows a form which may be used by a chief operator to keep a record of her operating costs. At the end of each month she enters in column 1 the number of subscribers' stations in her exchange, and in column 2 the amount of her pay roll for the month for local operators, local supervisors, etc. In column 3 should be entered the cost per station, which is found by dividing the amount in column 2 by the number in column 1. This cost per station can be compared from month to month. Such comparison will show whether the cost of operating is increasing or decreasing. It is much better to watch these cost per station figures than to watch the figures in column 1, because if the number of subscribers is increased the pay roll expense may be increased without necessarily increasing the average cost.

The simplest way to watch costs is to express them on a unit basis. In this case one subscriber's station is taken as a unit and the total expense expressed by giving the average cost of one unit. For instance, in January the exchange may have 1,500 subscriber's stations, with a pay roll expense for local operating of $300, in which case the cost per station would be 20 cents. By June this exchange may have grown to 1,700 stations, while the local pay roll for June is $357, which is 21 cents per station. Now, comparing June with January, it is seen that the cost of operating has been increased 1 cent per station. In other words, what was done in January for 20 cents is costing in June 21 cents. A chief operator, on being confronted with such a comparison, should at once look back over the way the work was done in January and see what she is doing now which is taking more time than it did in January.

Perhaps the increase is the result of a higher scale of wages. A comparison of the pay rolls will quickly show whether or not such is the case. If it is, the chief operator should then consider the results and can determine which scale is necessary and best. The wage scale is a matter of vital importance to every chief operator. Her success depends upon the efforts of her many employes, and the principal consid-

CHIEF OPERATOR'S COST STATEMENT

YEAR_____ _____OFFICE

| MONTH | LOCAL | | | TOLL | | |
|---|---|---|---|---|---|---|
| | NUMBER OF SUBSCRIBERS | PAY ROLL EXPENSE | COST PER STATION | NUMBER OF OUT MESSAGES | PAY ROLL EXPENSE | COST PER MESSAGE |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Jan. | | | | | | |
| Feb. | | | | | | |
| Mar. | | | | | | |
| Apl. | | | | | | |

Chief Operator's Form for Operating Costs.

eration with each of those employes, individually, is the salary they receive. If an operator thinks her salary is right, she is right, and can be depended upon to give the best that she is capable of giving. If she thinks her salary is wrong and unfair, she is wrong, her work is poor.

To determine what is a "right" salary requires investigation and consideration. The chief operator must consider, first what kind or class of girls she wants. In this she should be very careful. A girl's work is, of course, controlled by her brain. Telephone operating generally does not require any unusual amount of intelligence, but at the same time it is work of fine detail, which to be properly executed must be directed by an orderly, healthy brain. Girls with orderly, healthy brains are usually the children of good homes, with careful, discriminating parents; therefore, it is from such that the chief operator should draw her operating force.

Another reason for employing only girls of first-class reputation is that telephone service is a public service and telephone operators are public servants. As such they have a responsibility for reliability and dependability to the public as well as to their employer.

Having decided upon the class of girls she wants, the chief operator must next find out how much business demand there is for such girls in her town or

*An address to the chief operators of the Pioneer Telephone and Telegraph Company.

city, and what salary and condition of work these girls find in other lines. It is not always necessary to offer higher salaries than are offered by other employments in order to get plenty of applicants from whom to choose. The chief operator should advertise the numerous attractive features of telephone work. First and foremost of these is the opportunity for advancement. For the reason that telephone operating is done entirely by girls, there are many good positions for girl chiefs, supervisors, teachers, etc. The direction of this enormous force of girls offers exceptional opportunities for girls who have natural inclination for leadership.

Next is the point that telephone operating work is taught at the expense of the telephone company. The operator does not have to prepare herself by attending a business college, where she has to pay for her course of instruction. On the contrary, the telephone operators are usually paid by the telephone company while they are learning. The care that the telephone company takes of its operators is another desirable feature of the service. It will be found in nearly every city and town that the telephone company provides for its operators better working conditions and rest rooms than are offered by any other employers. The privacy of the operating room insures seclusion from the public. This is another feature which appeals to the desirable kind of girls. The fact that they are employed by a woman who understands women is also worth mentioning.

Telephone work is good discipline, and many of the traits developed in the operating room become personal attractions in the operator's individuality. For example, evenness of temper, unfailing courtesy, gentleness of voice, etc. All these points should be brought out by the chief operator when talking about the work. She should also speak plainly about salaries paid. A chief operator should be thoroughly convinced that the salaries she is paying are right. She should be prepared with such information on this subject as may be necessary to convince any one that her salaries are right.

The next thing in the problem of operating cost, after settling the salary question and getting the right kind of employes, is training those girls and getting full efficiency from them. There is a great deal of talk about efficiency now-a-days, and it is efficiency that counts in operating cost. By efficiency is meant the full productive power of the operating force. The full power and strength of the force will be exerted in getting results in telephone service if the force has the will and knows the way. They must have enthusiasm and they must "know how." Teaching them "how" should be easy for most chief operators, as they are generally perfectly familiar with the operating methods and, having done the work themselves, know what mistakes are likely to be made and what should be guarded against.

The instruction of the operator should be continued forever—that is, as long as she continues in the work. A capable chief operator can occasionally show her most experienced operator where she can improve, where she can accomplish the same results with less work, where she can cut out a useless little move, where she can avoid wasting energy. Many operators do a lot of hard work without accomplishing much in the way of results or service, because they do not set about their work in the right way. They waste so much time and energy saying and doing things which are unnecessary. The operators do not realize that these things are unnecessary, and it is the chief operator's duty to watch for these unnecessary steps in the work and point them out to her operators. When efficient operators are paid "right" wages and the operating cost is still high, the trouble may be in the operating schedule, that is, the arrangement of the operators' hours of duty.

The operating schedule should be drawn so that the number of operators on the board increases and decreases with the rise and fall in the amount of work. The rise and fall in the work will not be the same every day, but from the peg count a chief operator can judge fairly well how much work there is to be done in each hour of the day. She should assign her operators hours on the schedule, so that the work, as shown by the peg count, will be covered. She should avoid, as much as possible, having more operators in any hour than the work requires. She should also avoid not having enough.

Even the best of schedules may go wrong. Although the operators' hours of duty are arranged to exactly meet the traffic in the various hours of the day, as shown by the peg count, it may be found that in actual practice the arrangement is not all that it should be. It may be found that in some hours more operators have been provided than are needed. In this case, the chief operator should reduce her force on the switchboard and send those operators who are not needed to the rest room, where they will be available if the work increases. The reason for such action is that busy operators turn out better work than operators who have some idle time. If there is not enough work to keep the force busy continuously, their attention is likely to be attracted away from the work, and when a signal does come in they will be slow to see it, or when a ticket is dropped on a toll operator's position she will not notice it at once.

Another reason why busy operators do better work than operators carrying an underload is that they are happier and in a better frame of mind. If the operators do not have enough to keep them busy, the time drags and they become restless and impatient, whereas, if they are kept busy, the time passes quickly and the work is much more enjoyable.

By taking operators off the board and thus cutting down the working force, the chief operator has an opportunity to experiment and see just how much work her operators are able to carry; or, in other words, to test the ability of her force to handle heavy traffic. This test will give her valuable information, and it will give the force good practice. The service is perfectly safe, because the chief operator has the extra operators waiting in the rest room, and they can be brought back immediately if the reduced force cannot handle the work. If it is found that the working force can be reduced in this way, day after day, it is evidence that the schedule provides for more operators than necessary, and the chief operator should re-arrange her operators' hours and use a new schedule.

Again referring to the figure, column 4, 5 and 6 provide for information regarding the toll operating expense. In column 4 should be entered the outward paid and inward collect messages handled by the exchange during the month. In column 5 should be entered the toll operating pay roll expense for the

month. In column 6 should be entered figures arrived at by dividing the amount in column 5 by the number in column 4, which will give the cost per outward message.

This "cost per message" figure in toll is used in the same way that the "cost per station" figure is used in local. The chances are that the toll operating work at any office will increase at the same rate that the outward messages increase. That is why the outward message is taken as a unit. Of course, conditions do sometimes arise where this is not true, but the "per message figure will generally be found to answer the purpose very well for comparing the toll cost of an office from month to month. The count of outward messages is closely allied to the revenue earnings, and it is out of this revenue that the expense must be paid.

When there is a fluctuation in the traffic; that is, when the number of subscribers or number of toll messages is likely to suddenly rise or fall, such as at the commencing or ending of a busy business period, it is advisable for the chief operator to estimate or guess in the early part of each month what the expense for the month is going to be.

Here again the form shown in the figure may be used. The figures for column 1 can be estimated by adding to last month's figure the number of stations which the canvassing department expects to add to the subscribers' list during the month. Column 2 can be easily figured from the number of operators employed and their rates of pay. Column 3 is figured by dividing the amount in column 2 by the number in column 1. The number of messages to be entered in column 4 must be based on the chief operator's knowledge of general business conditions as compared with conditions in the month just past. But here, again, the local manager will be able to contribute valuable advice. In estimating this figure, care should be taken to allow for the proper number of business days, Sundays and holidays. Column 5 should be arrived at in the same way as is column 2 under local expense, and the figures for column 6 are determined by dividing the amount in column 5 by the number in column 4.

To know that expenses are too high after the money has been paid out may be of some benefit as a future guide, but good management would avoid such a condition, and this can be accomplished if the probable cost is known before the money is spent. After the month is over and the pay roll is made up it has to be paid, and it is too late then to make any saving. Therefore, a chief operator will do well to use this method of determining what her operating cost is going to be. If her guess shows that she will have spent too much money, she will know it in time to change her plans to meet the change in traffic.

Operating costs are like everything else. If you expect them to come out right you must look ahead, plan the future; in other words, estimate what your cost is going to be before you spend the money. In every large manufactory in the country the cost of making their product is known before the work is begun. In a telephone company the cost of every line and circuit is known before the orders to build are given. So in operating, the cost must be known before the operator is employed, otherwise our cost will be a matter of chance instead of management.

# The Law and the Telephone

By E. J. Wenner

CITY ORDINANCE COVERING TAXATION HELD INVALID—TELEPHONE COMPANY CANNOT BE TAXED BY MUNICIPALITY WHERE IT OWNS NO EXCHANGE NOR PHYSICAL PROPERTY WITHIN THE CORPORATE LIMITS.

THERE are many cases upon the question of the right of a city to tax a telegraph or telephone company which has an office and property within the taxing district, and does business between this particular district and another point, but until recently the courts had not been required to pass upon the right to tax a company which merely had connections within the taxing district.

The town of Harrisonburg, Virginia, brought suit against Southern Bell Telephone and Telegraph Company to collect a tax of $50. The town had by ordinance provided that telephone companies should pay an annual license tax for the privilege of carrying on business between the town and other points in the state of Virginia.

The town had duly taxed the company with license tax for the year commencing May 1, 1909, and upon its refusal to pay same brought action for its recovery.

The telephone company owned no wires, poles or property of any description within the limits of the town of Harrisonburg, but had entered into a contract with the Harrisonburg Mutual Telephone Company for the handling of toll business between the town of Harrisonburg and other points. This contract provided that the Mutual Company should own and maintain all equipment within the corporate limits of the town and that it should make connections with the defendant company outside of the corporate limits. The contract also provided for a division of the tolls and contained other provisions with reference to settlements, remittances, regulations, etc., etc.

The defendant company maintains that the judgment in the circuit court is erroneous, because the business is interstate commerce and should be free from state control, except such as is of a police character; that the town of Harrisonburg has no authority under its charter to impose a license tax for the privilege of doing business, and that it is not engaged in business within the town of Harrisonburg and is not therefore amenable to the imposition of a license tax even if its business were not interstate commerce.

The following is quoted from the two last paragraphs of the court's opinion: "We see no occasion to discuss the first and second propositions. The third ground of error is, we think, borne out by the record and is conclusive of this controversy. The Southern Bell Company has no franchise from the town of Har-

risonburg. It owns no property of any description within the limits of the town. It does no business within the town, directly or indirectly, through the agency of others. It makes telephonic connection outside of the limits of the town with the Harrisonburg Mutual Telephone Company, a wholly separate and independent corporation, which pays taxes on all of its property within the town of Harrisonburg, and has a license from the town to do a telephone business and is the sole licensee of the town for that purpose.

"We are of the opinion that the town of Harrisonburg has no authority to require a license of the Southern Bell Telephone Company and that the judgment imposing a fine for doing business without such license is erroneous and must be reversed."

Southern Bell Telephone and Telegraph Company vs. Town of Harrisburg, *69 Southeastern Reporter* 348, 31 *L. R. A.* (N. S.) 327.

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EXCLUSIVE CONTRACT IN HOTEL HELD ILLEGAL—COMPETING COMPANY MAY INSTALL SERVICE IN HOTEL—HOTEL OWNER BOUND BY HIS OWN CONTRACT.

On August 18, 1902, the Central New York Telephone and Telegraph Company entered into a contract with Charles F. Averill and others, operating the Yates hotel in the city of Syracuse, N. Y. By the terms of the contract the plaintiff company was given the exclusive right to place its telephone system in the hotel for the period of nine years.

The contract contained a provision which settles all controversies as to the ownership of the apparatus, wires, cables and fixtures, and also provides that the apparatus, wires, cables and fixtures of no other company or concern is to be placed in said hotel during the period of time covered by the contract.

There was a provision of the contract under which the defendants claimed a right to terminate same by giving thirty days' written notice, but as the court held that the facts did not justify cancellation under this provision, it had nothing to do with the decision of the case. In 1906 a rival telephone company sprang into existence and the defendants decided that it be used in their hotel. They gave notice to plaintiff that they would allow the rival company to install fixtures, and the plaintiff company sued out an injunction to restrain the defendants from installing the fixtures of the rival company in their hotel.

The court held the exclusive clause in the contract to be in restraint of trade and therefore void. It prevents any one in the hotel from having telephone communication with customers of other telephone companies than plaintiff; it prevents the persons served by such other companies from having telephone communication with the hotel or its guests. It likewise destroys competition by shutting out all rivals of plaintiff's.

In one respect the court held with the plaintiff in that it was entitled to maintain its exchange, fixtures, wires, cables, etc., in the hotel during the period of time covered by the contract, but it was not entitled under the law to refuse to the defendants the right to install a like system owned by a competitor. Such a contract the court held to be in restraint of trade and would give this plaintiff a monopoly to which it was not entitled.

Central New York Telephone and Telegraph Company vs. Averill, 199 *N. Y.* 128, 32 *L. R. A.* (N. S.) 494.

## Submarine Cable Repairing

Some time ago a fault developed in the British Columbia Telephone Company cable between the mainland and Vancouver Island, as a result of which the service was seriously impaired. The trouble was located in the 8,200-foot section between San Juan and Shaw Islands, in the Gulf of Georgia. A day and a half had been allowed for the work of removing the old cable and laying the new one, in expectation of certain difficulties to be overcome, but conditions proved so favorable and everything worked so smoothly owing to the careful preparations made, that the old cable was lifted and the shore end of the new section landed in exactly four hours and fifteen minutes. The new cable was 400 feet shorter than the old one, the saving being rendered possible owing to its being laid during a period of slack water, nothing being lost by the tide carrying the cable off the line of the surveyed route, as was the case when the first cable was laid six years ago. The section lifted and replaced had many worn spots in its protective covering, caused by chafing against the rocks under tidal action. In places the cable was as big around as a barrel owing to the accumulation of marine growth of various kinds.

## Company Gives Up Its Case

The war between Pasadena, Cal., and the Pacific Telephone & Telegraph Company, which has occupied the attention of the courts for many years, ended with a capitulation on the part of the telephone company. The corporation agreed to pay $31,030, which the city demanded as a condition precedent to even the consideration of an application for a franchise.

The money is an indemnity for the expenses incurred by the municipality for the expenses of the litigation, which hinged on the refusal of the telephone company either to apply for a franchise or to pay taxes on poles and other property.

In return for the company's payment, the city council has agreed to consider the application for the franchise.

## City Council Cannot Fix Rates

The circuit court at Tiffin, Ohio, has reversed the lower court in the case of the Tiffin Art Metal Company against the Tiffin Consolidated Telephone Company. The lower court held that cities have power to fix telephone rates. The circuit court holds that there is no such right given in the public utilities bill, and that cities have only the right to regulate the manner in which companies shall use the streets and alleys.

The Tiffin Art Metal Company filed suit a few weeks ago to secure an injunction to prevent collection of higher rates than those fixed by the council. The circuit court supports the contention of the telephone company.

## Settle Controversy With Cards

Two Montana subscribers on the same two-party line were recently persuaded that they needed one-party service, but a difference of opinion arose as to which should retain the line number, it being considered desirable on account of containing but two figures and being easy to remember. To settle the dispute, a game of seven-up was played, the winner keeping the old number and the loser getting a new one.

# Recent Telephone Patents

**By David S. Hulfish**

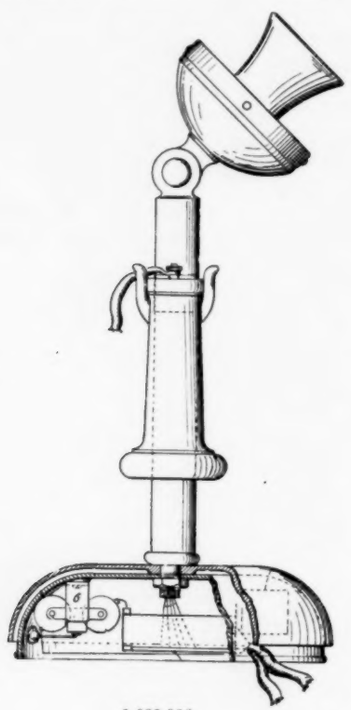
997,756. Signaling System. George C. Cummings, Western Springs, Ill. A system of signalling by battery currents over the telephone lines, suitable particularly for small and private telephone installations.

998,161. Magnetic Telephone Receiver. W. W. Dean, Elyria, Ohio, assignor to Dean Electric Company, of same place. A telephone receiver has a base or cup, and a number of E-shaped plates capable of carrying magnetism and mounted in the cup, the invention being found further in the means for clamping the E-plates to the cup.

1,002,832. Sound Conducting Attachment for Telephone Receivers. Charles H. Gatchell, Boston, Mass. A sound conducting attachment provided with a flat plate for covering the end of the telephone receiver, with hooks for holding it to the receiver; from this plate extend two outlets, one of them rigid for one of the ears of the user, and the other one flexible to reach the other ear of the user, thereby enabling one to listen with both ears.

1,002,878. Party-Line Telephone System. Sidney A. Souther, Chicago, Ill., assignor to Homer Roberts Telephone Company, of same place. The Homer Roberts system contemplates a continuous series of line-sections with adjacent ends, adapted to be built up into a continuous conducting line by joining the section ends. This patent contemplates a branch circuit from the line thus built up, having a number of stations upon such a branch line, with means for controlling the stations selectively.

1,002,891. Telephone System. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. A switchboard circuit for a common battery switch-



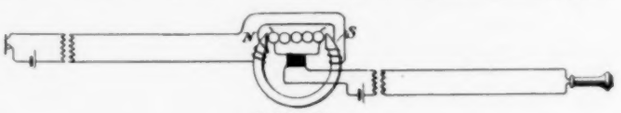
1,002,936.

board. The line relay has differential coils, one of the coils being normally in the line and in the voice current paths of the line during conversation, and the other coil being connected in parallel with the first coil during conversation, whereby the inductive effects of the first coil are neutralized.

1,002,936. Combined Desk Stand and Ringer. Roy E. Southwick, Los Angeles, Cal. The inventor shows two designs for his improved desk stand and ringer combined. In the first device, a gong is shaped like the dome base of the stand, and covers the base closely without touching it, being mounted upon the central shaft of the instrument; a ringer movement inside the base extends its tapper through an opening in the true base and taps upon the gong surrounding it. In the second design, the ringer gong surrounds the back or box of the transmitter, the ringer movement being compactly mounted within the transmitter box and projecting its tapper through to tap the gong.

1,003,250. Selective Signaling System. Edwin R. Gill, Yonkers, N. Y., assignor to H. E. Merrill, New York, N. Y., and Orlo J. Hamlin, Smethport, Pa. In a system of devices for calling selectively any one of a number of stations upon a party line, the inventor provides an answering device in connection with the called station which automatically places a return signal upon the line wires so that the calling station may be advised that the station desired has been called; this is independent of the actual answering of the called station, and renders the operation of the selecting system wholly within the knowledge of the operator. The system is designed particularly for train dispatching circuits.

1,003,337. Method of Relaying Voice Currents. Edward E. Clement, Washington, D. C. (Original application filed June




1,003,337.

16, 1898.) The inventor states: "My object is to eliminate what is known as the time constant. All telephonic relays at present in use are dependent for their operation upon the translation of electrical changes into mechanical changes, which are by a second operation translated again into electrical changes. I translate the current variations in one circuit directly into current variations in a second circuit by a single operation. To effect this, I employ a coil included in the first circuit and a resistance varying medium in the second, the latter directly acted on by the former, without any intermediate mechanism." In the structure shown, the variable resistance is of magnetic material, and is placed immediately in the field of the receiving magnet.

1,003,476. Telephone System. Albion D. T. Libby, Elyria, Ohio, assignor to Dean Electric Company, of same place. In an intercommunicating telephone system having a trunk to a common battery exchange, the attendant's station is provided with circuit closing relay coils and contacts for controlling the central office signals while the attendant is performing the duties incident to obtaining the called party to a conversation.

1,004,012. Telephone Speech Current Relay. Hans Gerdien, Halensee, near Berlin, Germany, assignor to Siemens & Halske A. G., Berlin, Germany. The combination of a secondary circuit comprising a source of current, a vacuum tube, and a primary circuit wound around the vacuum tube concentrically with the cathode.

1,004,101. Cabinet for Pole Changers and Their Batteries. Richard C. Stone, Muncie, Ind., assignor to Warner Electric Company, of same place.

1,004,244. Spring-Jack Switch. E. B. Craft, Hackensack, N. J., assignor to Western Electric Company, Chicago, Ill. A specific conformation of metal frame for strip jacks.

1,004,290. Telephone System. Charles W. McKibben, Beaumont, Texas. The telephone set of this system comprises a manual switch as a part, the switch having one position in which the transmitter is favored over the receiver, and another position in which the receiver is favored over the transmitter. With the switch normal the transmitter circuit is open, and the receiver is across the line; with the switch depressed, the transmitter is closed operatively, and a shunt is removed from a resistance in series with the receiver. The transmitter therefore is more effective upon distant stations by increasing the resistance of its own receiver path.

1,004,306. Switchboard Plug. Oscar A. Spencer, Bloomer, Wis., assignor of part to Joseph G. Prueher and Harold E. McWhitney, of same place.

1,004,566. Selective Signaling Device. Edwin R. Gill, Yonkers, N. Y., assignor to H. E. Merrill, New York, N. Y., and Orlo J. Hamlin, Smethport, Pa. The claims cover the combination of a pawl-propelled wheel with an inertia wheel frictionally engaged with it.

1,004,567. Edwin R. Gill, Yonkers, N. Y., assignor to H. E. Merrill, New York, N. Y., and O. J. Hamlin, Smethport, Pa. This selective line contemplates a metallic circuit equipped with selective stations, and a phantom circuit upon it, the phantom circuit also operating an independent telephone circuit.

1,005,194. Telephone System. T. W. Gleeson, Boston, Mass., and W. H. Gilman, Medford, Mass., assignors to International Telemeter Company. (Application filed 1907.) A system comprising a main line and a number of stations, and means at each station for operating the signal circuit of any other station to the exclusion of the signals of the remaining station, yet retaining the manually operating parts of all stations in operative condition.

1,005,283. Spring Clip or Spring Binding Post. Levi M. Neher, Milford, Ind., assignor to Fahnestock Electric Company, a corporation of West Virginia.

1,005,393. Telephone System. C. S. Winston and E. H. Rupe, Chicago, Ill., assignors to Kellogg Switchboard & Supply Company, of same place. (Filed, 1904.) A cord circuit for use with common battery and magneto lines, interchangeably, and having signals giving the same manifestations for either class of lines.

1,005,475. Thermal Electric Protector. Charles A. Rolfe, Adrian, Mich., assignor to Rolfe Electric Company, Rochester, N. Y. (Application filed April 21, 1902.) The protector contains a number of thermal devices, with means for including any one of them in the protected circuit, and means for restoring them after operation.

1,005,910. Strip-Mounted Key Switch for Telephone Switchboards. Alfred H. Weiss, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, of same place.

# Technical Features of Telephone Work

By R. M. Ferris*

TO give a general idea of the nature of the work required of technical men in a large telephone company, the nature of some of the larger problems which the technical men are constantly working on will be explain briefly.

The American Telephone and Telegraph Company, commonly known as the Bell Telephone Company, itself operates the long distance lines and maintains central departments dealing with engineering and other matters to develop new methods and new apparatus, to establish standards, and to act as consulting engineers for the other companies.

The very rapid advances which are now being made in many directions in the telephone art and the very large additions which all of the companies are making to their plants necessarily impose very serious responsibilities on the technical men in the business who are responsible for preparing the plans for the proper expenditure of very large sums of money and then seeing that the money is properly expended in accordance with the plans. Looked at from a purely scientific point of view, the importance of a given class of work would be independent of the amount of money, the expenditure of which was dependent upon it. From an engineering point of view, however, the amount of money to be expended has a great deal to do with the importance of the work. No matter how interesting from a scientific point of view a given question may be, from an engineering point of view it is of little or no importance if only the expenditure of a small amount of money is dependent upon it. On the other hand, if a method of expending large amounts of money is dependent upon the decision obtained on a certain physical question, then this question becomes one of great engineering importance. In the telephone business it is the combination of the large amount of money expended and the intersting scientific nature of the questions which must be solved in connection with its proper expenditure that make this work so absorbing to those engaged in it. The following I think will be sufficient to illustrate the nature of some of this work.

In order to establish telephone service in any large city, such as New York, or Brooklyn, or Buffalo, it is necessary, of course, to have one or more large central offices containing the telephone switchboards. The telephone lines throughout most of the city must be carried underground in telephone cables, which must be placed in telephone subways.

Before any actual construction of the plant can be intelligently done, it is necessary to know whether there should be one central office in the city or whether there should be more than one; where the office or offices should be located; how large the various switch boards should be; and of what type they should be. With reference to the subways and cables, it is necessary to know in what streets they shall be run; how large the subway system should be built; the types of cables that should be used; and many other points.

The solution of a problem such as this for any large city is a very complex engineering question, and it is to the solution of this problem as a whole or to the solution of various parts of it, that we have given the name of "Fundamental Plan."

The method of making a fundamental plan is briefly as follows: It has been determined that plans should be made for a period of about fifteen years, and estimates of the number of subscribers' lines which we will have in a city at the end of that period are made and a distribution of these lines laid out in the various sections of the city, the distribution being based on the character of the various sections and their possibilities of development as can be best foreseen. After this has been done, various arrangements of central offices are laid out—say an arrangement of five, ten, and fifteen offices. The total annual costs of each of these arrangements is determined, and the most economical arrangement selected.

The fundamental plan indicates what arrangement of offices it will be most economical to have at the end of the period in question; it does not indicate when or in what order the offices should be established, and there is a great deal of engineering required in the proper application of this plan in order that we may not only have a proper arrangement of offices at the end of the period in question, but that from year to year, as the plant grows, the number and arrangement of offices should be proper for the condition ex-

*Abstract of lecture by Mr. Ferris before the senior class in Electrical Engineering, Cornell University.

isting at that time. For example, in case a central office building is becoming congested, we have to consider whether it would be more economical—

1. To enlarge that building;
2. To take care of the growth by transferring a portion of the district to another district; or
3. To put up a new building and switchboard.

Besides these alternatives, there are often other alternatives which can be followed.

If we find that it is economical to establish a new central office building, the amount of space required for central office purposes and for other purposes is determined, and the most economical floor plan for such a building and the size and shape of lot necessary for its accommodation are next studied and determined. This information having been given to the business management, a search for real estate is made in the vicinity of the telephonic center as determined by the fundamental plan, and prices obtained on a number of sites located in the vicinity. After excluding those sites which are not of suitable size or shape, the remaining sites are considered and the asking price of the property weighed up against the costs for subways and cables, which costs are, of course, different for each site and which becomes greater and greater as the sites are located more distant from the telephonic centers, this center being by definition the point at which the subway and cable costs are a minimum.

Having determined the most economical site and this site having been purchased, the next point to be settled is to prepare the preliminary floor plans of the building which are to serve the architect as the basis for his work. The preparation of these preliminary plans involves working out in detail the design of the telephone switchboard in order to determine the amount of equipment of various classes to be provided. It involves a careful consideration of the matter of bringing the underground cables into the building and the arrangements through the building in order that such cables should be brought up to the terminal room, and a careful consideration of the location of the various parts of the telephone apparatus in order that such arrangements might be the most economical and convenient.

Having completed these preliminary plans and indicated not only the central office arrangements but also the arrangements for other purposes, the plans are placed in the hands of the architect who prepares the detailed plans and specifications. The architect's plans and specifications are, of course, checked and then the contract for the building is let.

Soon after the building is started the detailed plans and specifications for the telephone switchboard must be written and sent to the contractor who manufactures these switchboards. In connection with the design of the switchboard, much study of an engineering nature is required to determine what constitute desirable and economical operating methods. Our methods of handling business are not determined by the types of apparatus which we build, but the converse is true. The proper methods are first determined and then, as far as physical conditions will permit, apparatus is designed to meet those methods.

In additon to the work described above, the study and development of new methods of construction in what we call the "outside plant," which consists of underground conduits, underground and over-head cables, pole lines, etc., involves many engineering problems, in order to ascertain the most economical types of construction to meet various conditions. Much interesting work has been done recently with reference to timber preservation, design of concrete poles and other fixtures, design of submarine cables to meet peculiar telephone conditions, etc.

The efficiency of transmission of lines and apparatus is most important, and underlies the design of almost every part of the telephone plant. In power transmission work, it is necessary that considerable amounts of power be transmitted over lines with a small loss of power in the lines themselves. In telephone work it is necessary to transmit small amounts of power much greater distances, and it is necessary that there shall be, not only a small loss in the amplitude of the wave, but that the wave form itself shall not be distorted. Important studies are made to see that a proper grade of transmission is obtained in the most economical manner.

I think enough has been said in the foregoing to indicate that the telephone companies are constantly having to meet intricate technical questions on which important engineering work is required.

## Proxy Proposal by Telephone

Too shy to propose marriage after three years' courtship, two friends of Richard P. Ford of Indianapolis popped the question over the telephone for him to his sweetheart, Miss Luella Barlow.

Hello, is this Miss Barlow?" asked one, while the other held Ford.

"Will you marry Richard Ford if we get the license?" was the next querry.

Whatever the maiden said was not heard by Ford, but the friend shouted back:

"All right, we'll get the license and come right out."

That ended the proposal. Within a few minutes the license was obtained and arrangements made for the ceremony. The Fords are now on their honeymoon.

## Residence Telephones for Business Purposes

The Appellate Court at Indianapolis, Ind., has handed down a decision that a telephone company cannot remove a telephone from a private house because it believes the subscriber is using it for business purposes while paying a private residence rate. The decision was in the case of the Mooreland Rural Telephone Company vs. Joseph A. Mouch, appealed from Henry county.

Mouch owned an elevator and had a telephone in it and at his home. He refused to stand for an increase in rates for the elevator telephone and it was removed.

The company tried to raise the rate for the house telephone, alleging that it was used for business purposes. Mouch insisted to the contrary.

## Jersey Rate Inquiry Ordered

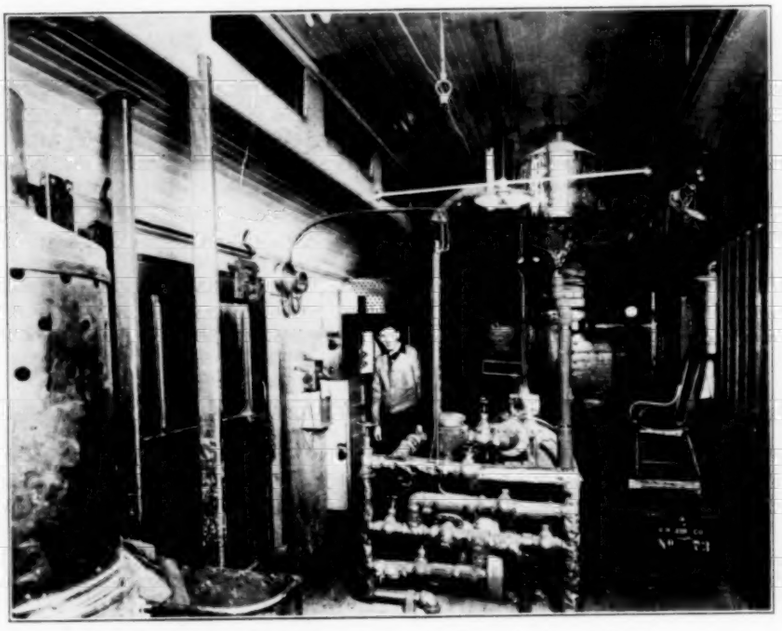
On the ground that the limited investigation it was conducting into the telephone rates charged in south Jersey by the Delaware and Atlantic Telephone and Telegraph Company was not getting the results desired, the board of public utility commissioners have ordered a statewide inquiry as to the tolls exacted by the company.

DEPARTMENT of RAILWAY TELEPHONES

# Great Northern Railway Telephones

By L. H. Osthoff

OPERATING what is probably the most extensive system of train dispatching telephones in use today, the Great Northern Railway is also one of the pioneers in the adoption of the telephone for this work. Six years ago the first circuit was installed on the Willmar division extending from Minneapolis to Breckenridge, Minn., a distance of 212 miles, while today the entire traffic on over three thousand miles of main line, and all the more important branches, a total of approximately forty-five hundred miles, is handled exclusively by telephone. Over this entire district the telephone has proven very satisfactory, notwithstanding that almost every kind of adverse climatic condition is encountered from the fogs of the Pacific to the severe wind and sleet of the Dakota prairies. Not a single dispatcher on the system who has once worked the telephone is willing to return to the "wire." The ease with which a station can be raised and the consequent saving of time, and the personal element introduced by the telephone, are probably the chief factors in its favor.



The Telephone in the Baggage Car on the Great Northern Railroad.

All telephone circuits are of No. 9 B & S gauge copper clad wire strung on pole lines ranging from thirty poles per mile in the prairie districts to fifty in the mountainous. Running type transpositions using a hanger-bracket are spaced one-third of a mile apart. Standard double petticoat porcelain insulators and steel pins are used. The wires are brought into the depots in either No. 14 B & S gauge hard drawn copper twin-twisted drop wire having 5/32-in. insulation, or through regulation five or ten twisted pair weather-proof cable, having either Nos. 14 or 16 B & S gauge copper conductors.

Non-test stations and blind sidings are only "tapped in" on the line, while at testing stations the ends brought to a combination testing and patching panel, designed by E. J. Little, superintendent of telegraph of the Great Northern. A diagram of the connections and wiring of this board is shown in Fig. 2. In addition to making ordinary tests it is possible with this board to substitute two telegraph wires for the telephone for emerg-

## Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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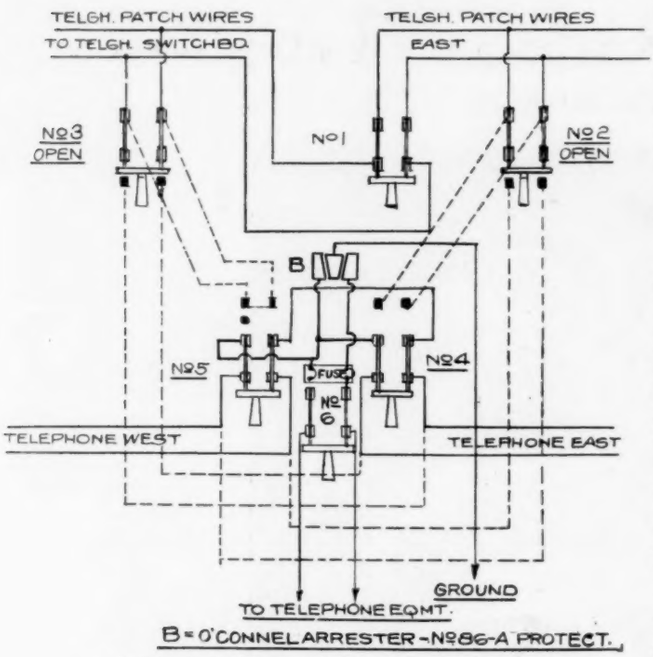
ency use and at the same time place the telephone pair into the telegraph circuits. Thus should only one side of the telephone circuit be in trouble, which is often the case, only one telegraph circuit is lost. These patch wires, not being transposed, pick up considerable induction from neighboring telegraph circuits, but for emergency use are very satisfactory, patches up to thirty miles in length having been worked successfully.

The transmission equipment or telephones proper are all equipped with high efficiency transmission circuits. Way stations are equipped with the regular transmitter arms designed for train-dispatching work, and the "blinds" with a special type wall set. Four selective ringing systems are in use on the various divisions, the Western Electric, the Gill, the Sandwich, and the Wray-Cummings. Protection from lightning has been a rather serious problem and no really perfect arrester




Combination Testing and Patching Panel Diagram.

has yet been found. The air gap type employing carbons giving a large exposed area seems to give the best results. All equipment is protected by one-half ampere fuses in addition to the arresters.

At present the telephone is but little used for message work. However, two divisions are so equipped, one of these, the Willmar, has a very heavy local message business which the telephone seems to be handling most successfully, and it is very probable that message circuits will be extended to other divisions soon. Recently Superintendent Little developed a portable telephone for emergency use, with which all passenger trains are now equipped. One of these sets is shown, in Fig. 1, in its place in the baggage car of the famous Oriental Limited. With this set communication with the dispatcher may be had at any point on the line, all that is necessary being to set up a sectional line pole, much as one would a fishing rod, and make connections with the line wires by means of suitable hooks at the top of the pole. A small book accompanies each set giving directions for the operation, and the location of the dispatcher's circuit on the pole line at any point on the system. The advantages of a train so equipped in case of an emergency are obvious. These sets were manufactured in the shops of the company, the necessary special telephone equipment being furnished by manufacturers. They have the same transmission circuit as that in the way station equipment, and a transmitter battery of three dry evil with a three-phase alternating current system, having a trolley voltage of 6,600 and it was feared that the same disturbances and interruptions which occurred on the telegraph circuits while the motors were in operation would be encountered on the telephone. However, this was not the case; the circuit being carefully balanced was found to be as quiet as any on the system. A twisted three-strand rubber insulated No. 14 B & S gauge copper conductor lead sheathed cable in one continuous run without potheads is used to conduct the circuit through the tunnel. The inductive disturbances which would occur on the open line due to closely paralleling the 33,000-volt transmission line for twenty-four miles from the power plant to the tunnel are taken care of by shortening the transposed sections, making them one-fourth instead of one-third of a mile in length.

## Buffalo, Rochester & Pittsburg to Use Telephone

The Buffalo, Rochester & Pittsburg Railroad has placed an order with the Western Electric Company for equipment to be used in connection with the introduction of train dispatching by telephone on a part of its system. Two separate train wire circuits will be installed. One will extend from Rochester to East Salamanca, New York, a distance of approximately 110 miles, with the dispatcher at Rochester, and the other from Buffalo, New York, to East Salamanca, a distance of approximately 65 miles, with the dispatcher at the latter place. Both of these division train wires will enter East Salamanca and provision will be made for establishing through connections between Buffalo and Rochester.

The apparatus ordered will provide equipment in all for 55 selector stations (way stations) and for the dispatchers' offices. Test panels are provided at way stations to permit of the use of the telegraph instead of the telephone wires, as desired. Apparatus is also to be supplied to enable various officials to listen in on the circuits and supervise the service.

A special feature is to be provided for about twenty way stations. This consists of a box, to be placed outside of each of these station buildings, containing equipment which will enable a train crew to get in touch with the dispatcher when the way station is closed at night. Connection is made to the line through the regular station wiring by means of a door switch and every train on each division will carry a portable telephone set which need merely be connected to the box equipment in order to communicate with the dispatcher.

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The Government telephone station in Malmo, Sweden, has been enlarged, so that it will now be able to handle 10,000 subscribers, and the arrangement is such that switchboard accommodation for 5,000 more can easily be installed in the present quarters when needed. The modern common battery system has been installed.

# A Study of Telephone Transmission

## Comparative Values of Line Materials*

LINE CONSTANTS OF COPPER-CLAD STEEL WIRE.

(2) *Self-inductance.*—The formulas for the self-inductance of the wires considered in the investigation are given below:

(a) Self-inductance of copper wire per loop mile, in henries,

$$L = 321{,}800 \times 10^{-9} \left( \frac{1}{2} + 2 \log_e \frac{d}{a} \right) \quad \ldots\ldots\ldots (10)$$

(b) Self-inductance of iron wire per loop mile, in henries,

$$L = 321{,}800 \times 10^{-9} \left( \frac{u}{2} + 2 \log_e \frac{d-a}{a} + 2u \log_e \frac{d}{d-a} \right) \quad (11)$$

(c) Self-inductance of copper-clad steel wire per loop mile, in henries,

$$L = 321{,}800 \times 10^{-9} \left\{ \left[ \frac{C_2^2 \, b^4}{[C_2 b^2 + C_1 (a^2 - b^2)]^2} \right] \left( \frac{u}{2} + 2 \log_e \frac{a}{b} \right) + \left[ \frac{2 C_1^2}{[C_2 b^2 + C_1 (a^2 - b^2)]^2} \right] \left( \frac{a^4}{4} + b^4 \log_e \frac{a}{b} - a^2 b^2 + \frac{3 b^4}{4} \right) + \left[ \frac{4 C_1 C_2 b^2}{[C_2 b^2 + C_1 (a^2 - b^2)]^2} \right] \left( \frac{a^2}{2} - \frac{b^2}{2} - b^2 \log_e \frac{a}{b} \right) + 2 \log_e \frac{d-b}{a} + 2u \log_e \frac{d}{d-b} \right\} \quad \ldots\ldots\ldots (12)$$

Where $d$ = Distance between the two wires.
$a$ = Radius of wire.
$b$ = Radius of steel core in copper-clad steel wire.
$S_1$ = Specific resistance of steel.
$S_2$ = Specific resistance of copper.
$\mu$ = Permeability of steel.

(3) *Electrostatic Capacity.*—The capacity of an aerial line is a function of the size of the wire, the separation between the two wires of the loop and the height of the wires from the ground, but is independent of the kind of line material. For the comparison of copper-clad steel wire with any other kind of line material, the separation between wires and the height from the ground will be assumed as being alike in all cases. Under this condition we shall need only to calculate the capacity for different sizes of wires, with a given fixed distance between wires and height from the ground. The influence of the height of the wires from the ground, when a loop line is considered, is practically negligible, so that the formula giving the capacity for an aerial line will be only a function of the size of wire and the distance between the two wires. The formula used for calculating the capacity per mile length of line in microfarads is

$$C = \frac{0.02786}{\log_e \frac{d}{a}} \times 10^{-6} \quad \ldots\ldots\ldots (13)$$

Where
$d$ = Distance between the two wires.
$a$ = Radius of wire.

(4) *Leakage Conductance.*—The leakage conductance is the reciprocal value of the insulation resistance. It should be noted that the insulation resistance of a line for telephonic purposes is far below that value which is ordinarily measured with direct current. The insulation of a line is considered good if the leakage conductance per loop mile does not exceed the value of $0.5 \times 10^{-6}$ mhos (2 megohms insulation resistance), because as long as it is above that value it has little effect on the transmission efficiency for the sizes of wires used in telephonic circuits. However, if it falls below that value, it quite rapidly becomes an important factor in the efficiency of the line, especially for the larger size wires.

The insulation of open aerial lines is dependent upon many factors, the most important ones being geographical location, weather conditions, number of lines, kind of insulators, number of crossarms, etc. It is fluctuating from day to day, and no definite value can be calculated or assumed which would cover all conditions.

It is customary to make transmission calculations for comparative purposes under the assumption of good insulation, a condition which prevails under dry weather. In this case its effect upon the transmission efficiency is small, and as long as the insulation resistance does not fall below 2 megohms per mile it makes little difference in the transmission what the insulation resistance really is. The transmission equivalents which are calculated for a negligibly small leakage conductance should therefore be regarded as the normal values.

Still conditions often arise where the insulation of the line is bad, and then it is important whether the value per loop mile is 500,000 or 250,000 ohms. As there is the possibility of obtaining better insulation under moist weather conditions on a copper-clad steel line, than on a copper line, due to the fact that the copper-clad line can be built with less poles per mile than the copper line, the transmission efficiency will also be calculated for insulation resistances of 1.0, 0.5 and 0.25 megohms per mile.

After having settled the value for the leakage conductance and derived the formulas for the other three constants of the copper-clad line, we could proceed with the calculation of these constants, but the formulas show that besides some dimensions, which are easily obtainable from the wire, and the frequency, which is fixed at 800 p. p. s., we need the specific resistance and the permeability of the material. The specific resistance is well known, but it was necessary to make some investigation in regard to the permeability.

*A report on the comparative efficiency of copper, iron and copper-clad steel wires for telephone transmission, made to Frank R. Chambers, Jr., vice president of the Duplex Metals Company, Chester, Pa., June 20, 1911. Continued from December.

THE PERMEABILITY OF STEEL IN COPPER-CLAD STEEL WIRE.

The correct method of determining the permeability of the steel in copper-clad wire is the measurement of the inductance of the wire under just the same conditions as those which obtain when the wire is used as a line material; that is, the wire should be suspended in a loop. A method with which fairly reliable results could be obtained on a short (100 feet) length of suspended wires was not at hand, and tests were started with a view of developing a method for such measurements.

At the same time a known, but for our purpose erroneous, method was used for measuring the permeability, only to get the order of magnitude. This was the test made on a toroidal coil. The inductance of the coil could easily be measured, and from its inductance values the permeability is found. The values so obtained are too small, on account of having the steel in the copper-clad wire magnetized longitudinally instead of in a circular direction, as in the case where the wire is used as a line material.

The copper shell of the copper-clad, if the wire be magnetized longitudinally, is very favorably located for the generation of eddy currents, and such currents in the copper shell partly demagnetize the steel core and make it apparently of low permeability. Indeed, the results of this test gave a permeability for the steel varying from 25 down to 5 for frequencies of 445 to 2,000 p. p. s. The effective resistance of the coil was several times its d. c. resistance, due to the large eddy currents in the copper shell. Since we later succeeded in getting a correct method for the measurement of the permeability, these results will be dismissed from consideration altogether.

The first measurements on suspended wire were made on a copper-steel-copper wire. From the results thus obtained I determined to utilize for the investigation on copper-clad wire the inductance measurements with a 12-inch separation between wires and a current of 50 milliamperes, from which the permeability of the steel in the core could be calculated. It ought to be approximately the same as that of the steel in the copper-clad wire if the steel in both is the same.

Assuming that the copper-steel-copper wire which was tested had only 30 per cent steel and 70 per cent copper, the permeability of the steel was found by calculation to be as follows:

| Frequency. | Permeability. |
|---|---|
| 500 | 27 |
| 700 | 23 |
| 1,025 | 19 |

There is a large discrepancy between the observed and the calculated d. c. resistance of the copper-steel-copper wire, which was explained by Mr. Stevenson as being due to the formation of a copper-iron alloy. If this is so, we find that the alloy has a smaller conductivity than any one of its components; then it has positively changed one physical property and very likely the permeability is changed too. We therefore cannot use the measured permeability of the steel of a copper-steel-copper wire for the permeability of the steel in the copper-clad steel wire.

A new test was therefore made directly on a copper-clad steel wire. The measured values of apparent inductance and apparent resistance are given in report No. 10,927 of the Electrical Testing Laboratories. Using the figures for the inductance of the copper-clad steel wire, the permeability of the steel was calculated for different frequencies and for small current strengths through the wire.

The same tests were made on galvanized iron wire of the grades E. B. B. and B. B.; Table I gives the calculated values of the permeability for different frequencies for the steel in the copper-clad wire and for galvanized iron wire:

TABLE I.

*Permeability of Steel Wire for Small Magnetizing Forces.*

| Frequency. | Steel in Copper Clad Steel Wire. | Galvanized Iron Wire E. B. B. | Galvanized Iron Wire B. B. |
|---|---|---|---|
| 440 | 85 | 88 | 86 |
| 500 | 80 | 84 | 84 |
| 600 | 77 | 79 | 78 |
| 800 | 68 | 71 | 70 |
| 1,000 | 59 | 63 | 63 |
| 1,200 | 51 | 57 | 57 |
| 1,400 | 43 | 52 | 51 |
| D. C. | 102 | .. | .. |

The values in this table are in fairly good agreement with each other, thus indicating that the steel in the core of the copper-clad steel wire is about the same with regard to permeability as galvanized iron wire. The figures also check closely the permeability computed from data given in a paper on "Telephone Transmission," by J. G. Hill, of the engineer in chief's office, general postoffice, London. In a table on page 7 he gives the self-induction of a galvanized iron wire line as 0.012 henry per loop mile. From this value of inductance the permeability of the iron is computed to be 62, for a frequency of 750 p. p. s.

As a result of these tests the permeability of the steel in the copper-clad wire was found to be 68, for 800 p. p. s., and this value was used for all calculations. By interpolation the permeability for low frequencies (60 cycles) is 100, which is for small magnetizing forces. For larger forces—that is, for currents larger than 1 ampere—the average permeability is about 125.

CALCULATION OF LINE CONSTANTS FOR COPPER-CLAD STEEL WIRE.

All calculations are here made for a frequency of 800 p. p. s. and for a line length of one mile (two miles of wire). The copper-clad wire was regarded as composed of 40 per cent copper and 60 per cent steel on a volume basis. The material properties and dimensions used are given below:

$2\pi \times$ frequency $= 5{,}000$
$S_1 =$ specific resistance of steel $= 0.14\ \omega$ per $m/mm^2$
$S_2 =$ specific resistance of copper $= 0.017\ \omega\ m/mm^2$*
$\mu =$ permeability of steel $= 68$
$d =$ distance between wires $= 30\ c/m$**

Further data are tabulated below:

| Size of wire B. & S. G. | Diameter of compound wire c-m. | Area of compound wire c-m. | Area of steel core c-m. | Radius of compound wire a c-m. | Radius of steel core b c-m. |
|---|---|---|---|---|---|
| 4 | 0.519 | 0.212 | 0.1272 | 0.2595 | 0.2010 |
| 5 | 0.462 | 0.168 | 0.1008 | 0.231 | 0.179 |
| 6 | 0.412 | 0.133 | 0.0798 | 0.206 | 0.1595 |
| 7 | 0.367 | 0.1055 | 0.0633 | 0.1835 | 0.142 |
| 8 | 0.326 | 0.0836 | 0.05016 | 0.163 | 0.1265 |
| 9 | 0.291 | 0.0663 | 0.03978 | 0.1455 | 0.1125 |
| 10 | 0.259 | 0.0526 | 0.03156 | 0.1295 | 0.100 |
| 11 | 0.231 | 0.0417 | 0.02502 | 0.1155 | 0.089 |
| 12 | 0.205 | 0.0331 | 0.01986 | 0.1025 | 0.0795 |
| 13 | 0.183 | 0.0263 | 0.01578 | 0.0915 | 0.071 |
| 14 | 0.163 | 0.0208 | 0.01248 | 0.0815 | 0.063 |
| 15 | 0.145 | 0.0165 | 0.00990 | 0.0725 | 0.056 |
| 16 | 0.129 | 0.0131 | 0.00786 | 0.0645 | 0.050 |
| 17 | 0.115 | 0.0104 | 0.00624 | 0.0575 | 0.045 |
| 18 | 0.102 | 0.0082 | 0.00492 | 0.051 | 0.0396 |
| 19 | 0.091 | 0.0065 | 0.00390 | 0.0455 | 0.0352 |
| 20 | 0.081 | 0.0052 | 0.00312 | 0.0405 | 0.0315 |

*Apparent Resistance.*—By using formula (9), the ratio *Rac/Rdc* has been calculated. This gives

*This means a wire one meter long and a cross-section of one square millimeter.

**This means centimeters.

the increase of the a. c. resistance over the d. c. resistance for the copper-clad wire. The frequency used is 800 p. p. s. Table II gives the calculated values, from which only the figures in the last column will be needed, as they show the resistance increase directly in per cent. For example, the apparent or a. c. resistance of a No. 7 B. & S. G. copper-clad steel wire is 2.8 per cent larger than its d. c. resistance; and whatever the d. c. resistance of a sample of No. 7 copper-clad steel wire may be, its a. c. resistance is obtained by multiplying the d. c. value by 102.8. The resistances of the compound wire, given in Table II, will not be used, since they only served for the calculation of the ratio given in the last column. The d. c. resistance values for the copper-clad wire will be taken from the catalogue.

*Self-induction.*—Calculation of the self-inductance were made with the aid of formulas (10) and (12). The results are given in Table III.

*Capacity.*—Employing formula (13), the capacities were computed, and are also given in Table III.

TABLE II.

*Determination of A. C. Resistance Increase of Copper Clad Steel Wire.*

| Size of Wire B. & S. G. | Calculated resistance of steel core D. C. Res. Ohm | Calculated resistance of steel core A. C. Res. Ohm | Calculated resistance of copper shell D. C. Res. Ohm | Calculated resistance of copper shell A. C. Res. Ohm | Resistance of compound wire for D. C. Res. Ohm | Resistance of compound wire for A. C. Res. Ohm | $R_{AC}/R_{DC}$ |
|---|---|---|---|---|---|---|---|
| 4 | 35.4 | 52.8 | 6.45 | 6.7 | 5.45 | 5.95 | 109.2 |
| 5 | 44.7 | 61.2 | 8.15 | 8.3 | 6.9 | 7.32 | 106.0 |
| 6 | 56.5 | 70.6 | 10.28 | 10.36 | 8.7 | 9.05 | 104.1 |
| 7 | 71.3 | 83.4 | 12.96 | 13.02 | 10.96 | 11.27 | 102.8 |
| 8 | 89.9 | 99.8 | 16.37 | * | 13.82 | 14.01 | 101.3 |
| 9 | 113.3 | 121.2 | 20.62 | * | 17.54 | 17.7 | 100.9 |
| 10 | 143.0 | 150.0 | 26.04 | * | 22.01 | 22.02 | 100.7 |
| 11 | 180.0 | 185.4 | 32.74 | * | 27.67 | 27.8 | 100.5 |
| 12 | 227.0 | 232.0 | 41.40 | * | 35.0 | 35.17 | 100.4 |
| 13 | 286.0 | 289.0 | 52.1 | * | 44.1 | 44.2 | 100.2 |
| 14 | 361.0 | 363.0 | 66.0 | * | 55.7 | 55.8 | 100.18 |
| 15 | 456.0 | * | 82.9 | * | * | * | 100 |
| 16 | 574.0 | * | 103.1 | * | * | * | 100 |
| 17 | 723.0 | * | 130.1 | * | * | * | 100 |
| 18 | 916.0 | * | 165.7 | * | * | * | 100 |
| 19 | 1155 | * | 210.4 | * | * | * | 100 |
| 20 | 1446 | * | 260.3 | * | * | * | 100 |

*Resistance for A. C. is practically the same as that for D. C.

TABLE III.

*Selfinduction and Capacity of Aerial Lines.*

| Size of wire B. & S. | Self-induction of copper clad per loop mile Henry | Self-induction of pure copper per loop mile Henry | Capacity per loop mile Microfarad |
|---|---|---|---|
| 4 | 0.00365 | 0.00322 | 0.00940 |
| 5 | 0.00370 | 0.00330 | 0.00918 |
| 6 | 0.00374 | 0.00336 | 0.00895 |
| 7 | 0.00378 | 0.00344 | 0.00877 |
| 8 | 0.00386 | 0.00352 | 0.00856 |
| 9 | 0.00390 | 0.00359 | 0.00838 |
| 10 | 0.00394 | 0.00366 | 0.00820 |
| 11 | 0.00400 | 0.00374 | 0.00804 |
| 12 | 0.00408 | 0.00381 | 0.00786 |
| 13 | 0.00415 | 0.00388 | 0.00772 |
| 14 | 0.00420 | 0.00397 | 0.00755 |
| 15 | 0.00426 | 0.00404 | 0.00742 |
| 16 | 0.00433 | 0.00414 | 0.00726 |
| 17 | 0.00443 | 0.00418 | 0.00715 |
| 18 | 0.00449 | 0.00426 | 0.00700 |
| 19 | 0.00454 | 0.00433 | 0.00688 |
| 20 | 0.00462 | 0.00442 | 0.00675 |

This table shows the different amounts of self-inductance due to different parts of the copper clad steel wire, and for the pair of wires as a whole.

| Size of wire B. & S. | Self-induction due to field in copper shell and air space Henry | Self-induction due to field in steel core Henry | Total self-induction in copper clad Henry |
|---|---|---|---|
| 4 | 0.00310 | 0.000552 | 0.00365 |
| 5 | 0.00318 | 0.000522 | 0.00370 |
| 6 | 0.00325 | 0.000491 | 0.00374 |
| 7 | 0.00332 | 0.000464 | 0.00378 |
| 8 | 0.00341 | 0.000451 | 0.00386 |
| 9 | 0.00348 | 0.000426 | 0.00390 |
| 10 | 0.00354 | 0.000396 | 0.00394 |
| 11 | 0.00362 | 0.000382 | 0.00400 |
| 12 | 0.00370 | 0.000383 | 0.00408 |
| 13 | 0.00378 | 0.000372 | 0.00415 |
| 14 | 0.00385 | 0.000352 | 0.00420 |
| 15 | 0.00392 | 0.000336 | 0.00426 |
| 16 | 0.00399 | 0.000336 | 0.00433 |
| 17 | 0.00408 | 0.000348 | 0.00443 |
| 18 | 0.00416 | 0.000325 | 0.00449 |
| 19 | 0.00423 | 0.000312 | 0.00454 |
| 20 | 0.00431 | 0.000312 | 0.00462 |

## New York Commission News

The New York Public Service Commission, Second District, has received a petition from the Meridian Telephone Company of Meridian, N. Y., asking that the New York Telephone Company be required to show cause why it should not be ordered to connect with the Meridian Telephone Company for interchange of traffic and communication. The petition states that in 1905 it made a contract as a connecting company with the New York Telephone Company, but that in September, 1911, the New York Telephone Company cancelled the contract because of arrears for rentals of telephones for a period of more than thirty days, but agreed upon payment to them of said arrears, to enter into an agreement with the Meridian Telephone Company, but that after the indebtedness was paid, the New York Telephone Company refused to ratify the contract between the two companies for the reason that they had given to the Cato and Meridian Telephone Company the exclusive contract for interchange of traffic in that district; that by reason of this refusal the members and patrons of the Meridian Telephone Company have been discriminated against illegally and unconstitutionally and that no valid reason exists whereby the New York Telephone Company should not enter into an agreement or contract for one year with the Meridian Telephone Company under the same terms given to other connecting companies. The New York Telephone Company has been required to answer the complaint within ten days.

The commission has received a complaint from the Lenham Mercantile Company and others of the city of Lackawanna, N. Y., directed against the New York Telephone Company. The complaint alleges that for the past ten years telephone service has been furnished for the sum of $108 per year, which included communication in the city of Lackawanna and any part of the city of Buffalo; that the company has inaugurated a new rate schedule which provides for a flat rate with subscribers within the corporate limits of the city of Lackawanna, village of Blasell, and part of the towns of West Seneca and Hamburg, for $50 per year, the new local area to be known as Lackawanna, and providing for a toll rate of five cents per message between Lackawanna, and Buffalo, Gardenville, Hamburg, Orchard Park and Wanaka; that the rate of $50 per year for service within the Lackawanna area is unjust and unreasonable because of the small number of subscribers within that territory. The complaint has been served upon the company with an order to answer the same within ten days. Pending a decision of the case upon its merits the commission has suggested to the complainants that they sign the new contract as drafted by the company, having induced the latter to incorporate a ten day cancellation clause.

The commission has received a complaint from residents of Cadyville, Clinton county, asking the commission to require the Delaware and Hudson Company to install a telephone of the New York Telephone Company in the station at Cadyville for the convenience of patrons in transacting business with the agent of the company.

The commission has closed upon its records the complaint made by residents of Warsaw against the American Express Company and the Wells-Fargo & Company Express as to the refusal of each of these companies to install a telephone of the Federal Tele-

phone Company in local offices in that village. Upon a hearing had upon the complaint the companies have agreed to install the Federal service for a period of six months to ascertain the need of the same.

The tentative form of a proposed order requiring companies to stencil and number their poles and structures for carrying overhead wires has been prepared by the New York Public Service Commission, Second District. The order is to apply to all electrical, municipal, telephone, telegraph, railroad and street railway corporations. A formal hearing upon the form of the order was held by the commission November 23. Objections to the order were made by representatives of steam and electric railways and telephone and telegraph companies. Mr. C. G. M. Thomas, Long Island City, vice-president of the Empire State Gas & Electric Association, presented on behalf of the association a suggestion for amendment of the form of the order. It was suggested that the order omit all details as to size and height of lettering on poles, and that it specify merely that each pole be marked in some way that would indicate the ownership clearly. It was also suggested that the lettering be readable, under ordinary circumstances, at a distance of 6 feet.

The Public Service Commission, Second District, has served upon the New York Telephone Company the complaint of J. Stevens Ulman of New York City against the increase in telephone rates from $6 to $12 per annum for extension telephones. The complaint has been served upon the company and an answer required within ten days.

The commission has received a complaint from the Beecher-Lisle Telephone Company, Owego, N. Y., against the New York Telephone Company on account of increases in rates for switching service to the complainant from $3 to $6 per year. The complaint alleges that the rate now charged is exorbitant and unjust and the commission is asked to fix a proper rate. The Beecher-Lisle Company is a mutual company and does not derive any revenue except from mutual shareholders. The company has been asked to answer the complaint within twenty days.

# Chicago Meeting of Superintendents

ON November 23 and 24, some sixty members of the Association of Railway Telegraph Superintendents met in Chicago for a joint convention of the eastern and western sections. The session was held in the Northwestern Railway Company's building.

Charles Selden of the B. & O., chairman of the eastern division, presided the first day, while E. A. Chenery of the Missouri Pacific, chairman of the western division, presided during the second day of the session. Considerable time was taken up in a discussion of the standing under the postal laws of communications from joint telegraph superintendents to joint operators, also in regard to the retention in the file of all telegrams as ordered by the Interstate Commerce Commission, and what plans have been worked out for relieving the files of the resulting congestion. The associate members had arranged for an informal luncheon at the La Salle, at which all of the members were guests. The remainder of the first day was spent in sight-seeing.

The keynote of the discussion the second day was telephone economy. There were discussed such subjects as:—

Number of inspectors or maintainers for a telephone dispatching circuit.

Rate of pay for inspectors.

Statistics as to economy in train operation since the adoption of the telephone.

It was agreed that the handling of trains has been greatly facilitated by the use of the telephone, and that it has produced savings in coal, overtime, and other expenses, and yet it would be difficult to measure in exact terms of dollars and cents the precise saving that should be credited to the telephone. The saving has varied according to conditions. A hope was expressed that all the members would do their part toward contributing statistics relating to economies brought about by the telephone.

Mr. Walstrum stated that it has cost his road $1.01 per road mile per annum to maintain telephones. This cost is complete, including even the wages of maintainers. A supervisor, receiving a salary of $110 a month, has charge of all telephone work. A single man at one of his stations is able to handle three dispatching districts by telephone.

Mr. Chenery stated that his road has one maintainer on 155 miles who gets $90 per month and expenses.

Mr. Rhoads stated that his road has increased its wire mileage by 3,000 miles, and has added a number of siding telephones. Three inspectors cover 1,400 miles of road. No additional linemen were needed to care for the additional mileage of line. A goodly number of motor cars are provided, for Mr. Rhoads is a firm believer in the ability of the motor car to pay its way by saving the time of the men. Mr. Rhoads called attention to the safety of train dispatching by telephone as compared with telegraph. An operator can send "Morse" much faster than he can receive it, and when the dispatcher is very busy and working at top speed, the receiving operator can scarcely get more than one word out of three. In filling in, a man is likely to get a wrong train number, time, or station. With the telephone, these mistakes do not occur, for as the dispatcher gives the order he writes it down, which gives ample time for the receiving operator to write it down also.

The desire of all the members to have more statistics bearing on the economies of telephone dispatching led to the appointment of the following committee: U. J. Fry, W. W. Ryder, and W. F. Williams.

The question of simplex circuits came up and a very full discussion ensued. The simplex is a distinct benefit to telephone service, as was shown by the many cases cited.

Two members and three associate members were elected. The newly elected members are: C. A. Worst, Asst. Supt. of Telegraph, C. B. & Q., Chicago; C. P. Dugan, Supt. of Transportation, Norfolk & Southern, Norfolk, Va. The associate members elected were: B. S. Stewart, Standard Underground Cable Co., Chi-

cago; R. E. Green, Standard Underground Cable Co., Chicago; C. S. Pflasterer, National Carbon Co., Cleveland.

Among those who attended this session were:

W. W. Ashald, supt. tel. G. T., Montreal, Quebec; William Bennett, supt. tel. C. & N. W., Chicago, Ill.; F. E. Bentley, supt. tel., T. R. R. Assn., St. Louis, Mo.; C. W. Bradley, actg. supt. tel., C. & O., Richmond, Va.; George Boyce, supt. tel., C. St. P. M. & O., St. Paul, Minn.; W. J. Camp, elec. engr., Can. Pac., Montreal, Quebec; G. A. Cellar, supt. tel., Pennsylvania Lines west of Pittsburg, Pittsburg, Pa.; E. A. Chenery, supt. tel., Mo. Pac., St. Louis, Mo.; J. P. Church, chief clerk, Wabash, Decatur, Ill.; M. H. Clapp, supt. tel., Northern Pac., St. Paul, Minn.; W. P. Cline, supt. tel., A. C. Line, Wilmington, N. C.; W. L. Connelly, supt. tel., C. I. & S., Gibson, Ind.; E. E. Dildine, asst. supt. tel., N. Pac., St. Paul, Minn.; G. A. Dornberg, gen. foreman, Pennsylvania Lines west of Pittsburg, Pittsburg, Pa.; P. W. Drew, supt. tel., M. St. Paul & S. S. M., Chicago, Ill.; L. B. Foley, supt. tel., D. L. & W., New York, N. Y.; S. A. D. Forristall, supt. tel., B. & M., Boston, Mass.; U. J. Fry, supt. tel., C. M. & St. Paul., Milwaukee, Wis.; E. P. Griffith, supt. tel., Erie, Jersey City, N. J.; W. H. Hall, supt. tel., M. K. & T., Denison, Tex.; E. D. Hubbard, gen. foreman, G. T., Battle Creek, Mich.; H. L. Husted, div. opr., W. J. & S. R. R., Camden, N. J.; L. M. Jones, supt. tel., A. T. & S. F., Topeka, Kans.; E. C. Keenan, supt. tel., L. S. & M. S., Cleveland, Ohio; V. T. Kissinger, supt. tel., C. B. & Q., Chicago, Ill.; E. J. Little, supt. tel., Great Northern, St. Paul, Minn.; W. Marshall, supt. tel., C. P., Toronto, Ont.; J. T. Nolan, chief opr., Wash. Terml., Washington, D. C.; C. A. Parker, supt. tel., D. N. W. & P., Denver, Colo.; E. A. Patterson, asst. supt. tel., C. M. & St. P., Chicago, Ill.; G. O. Perkins, supt. tel., C. G. W., Chicago, Ill.; C. S. Rhoads, supt. tel., C. C. C. & St. L., Indianapolis, Ind.; Thomas Rodger, inspr. tel., G. T., Montreal, Quebec; J. J. Ross, supt. tel., Mich. Central, Detroit, Mich.; W. W. Ryder, gen. supt. tel., N. Y. Central Lines, Chicago, Ill.; C. Selden, supt. tel., B. & O., Baltimore, Md.; N. E. Smith, supt. tel., N. Y., N. H. & H., New Haven, Conn.; F. S. Spaford, asst. supt. tel., C. R. I. & P., Chicago, Ill.; A. B. Taylor, supt. tel., N. Y. C. & H. R., New York, N. Y.; H. D. Teed, supt. tel., St. L. & S. F., Springfield, Mo.; H. A. Tuttle, gen. supt. tel., M. St. P. & S. S., Minneapolis, Minn.; F. H. Van Etten, supt. tel., C. T. H. & Sou., Chicago, Ill.; H. A. Vaughan, asst. supt. tel., C. B. & Q., Lincoln, Nebr.; J. M. Walker, supt. tel., D. & R. G., Denver, Colo.; W. C. Walstrum, supt. tel., N. & W., Roanoke, Va.; B. Weeks, supt. tel., Ill. Central, Memphis, Tenn.; F. T. Wilbur, supt. tel., Ill. Central, Chicago, Ill.; W. E. Williams, supt. tel., S. A. Line, Portsmouth, Va.; C. A. Worst, asst. supt. tel., C. B. & Q., Chicago, Ill.; C. P. Dugan, supt. trans., Nor. & Sou., Norfolk, Va.

Associate members present were:

W. L. Cook, sales engr., U. S. Electric Company, Chicago, Ill.; George M. Dodge, Dodge Institute, Valparaiso, Ind.; Albert Douglas, A. T. & T. Company, Chicago, Ill.; F. F. Fowle, consulting electric engineer, Chicago, Ill.; A. G. Francis, Chicago Telephone Company, Chicago, Ill.; G. K. Heyer, Western Electric Company, New York, N. Y.; Henry Homer, A. T. & T. Company, Philadelphia, Pa.; B. A. Kaiser, A. T. & T. Company, New York, N. Y.; J. C. Kelsey, Kellogg Switchboard & Supply Company, Chicago, Ill.; M. E. Launbranch, Sandwich Electric Company, Chicago, Ill.; H. E. Merrell, gen. mgr., U. S. Electric Company, New York; G. W. Peck, A. T. & T. Company, New York; H. O. Rugh, Sandwich Electric Company, Sandwich, Ill.; Archibald Wray, Kellogg Switchboard & Supply Company, Chicago, Ill.; B. S. Stewart, Underground Cable Company, Chicago, Ill.; R. E. Green, Underground Cable Company, Chicago, Ill.; C. S. Pflasterer, National Carbon Company, Cleveland, Ohio.

## Message Service

The Lake Shore & Michigan Southern Railroad is preparing to install telephones in order to open message circuits on two of its divisions, and has recently placed an order with the Western Electric Company for the apparatus to be used for this purpose.

The message circuits, which will be used mainly for the transaction of miscellaneous railway business between division and intermediate points, will parallel existing circuits used for dispatching trains by telephone and will extend from Toledo, Ohio, to Elkhart, Ind., a distance of approximately 145 miles, and from Fort Wayne, Ind., to Jackson, Michigan, a distance of about 100 miles. Thirty-three selector stations will be equipped on the first named division and twenty-two on the latter, and No. 9 B. & S copper used for the line wire. The message operators will be located at Toledo, Ohio, and Hillsdale, Mich., respectively.

## Gill Selectors Being Installed

The Chesapeake & Ohio Railway, which has had for some time more than 200 Gill selectors in service in telephone train dispatching has now ordered from the United States Electric Company, of New York, 52 additional selectors for a farther extension of its circuits.

The Central Vermont Railway, also a user of Gill selectors, has recently received 31 additional selective station outfits from the United States Electric Company, with automatic sending keys for the dispatcher's station.

Another repeat order for Gill selector equipment recently delivered was from the New Iberia & Northern Railroad, in extension of its circuits.

## Report on Tunnel Telephones

City Electrician William Carroll, of Chicago, has submitted a report that has been in process of making for several months finding that the Illinois Tunnel Company complied with the provisions of its ordinance requiring it to have 20,000 telephones installed by June 1. Action on this report will be taken up at a special meeting of the committee on gas, oil and electric light.

A report similar in substance was submitted some time ago, but was referred back for a more careful checking up. Mr. Carroll now has the report complete and his findings are that the company had the required number of telephones at the time limit.

A number of large firms in London have made arrangements for receiving orders for goods by telephone at all hours of the night, the articles required being dispatched by the first delivery in the morning.

# The Nerves of the Railroad

By Charles S. Mariner

WITHIN a period of less than five years a gradual, but none the less decided and revolutionary change has been made in the making in the method of transmitting intelligence over railroad systems. The railroads which interlace the United States are one by one abandoning the use of the time-honored telegraph for this purpose, and are replacing it with telephone equipment so that at present eighty-seven steam roads are employing the telephone method of handling their train movements over an aggregate of some 60,000 miles of line.

The many advantages accruing from the use of the telephone instead of the telegraph for the dispatching of trains, alone were responsible for its adoption. The telephone, in the first place, is quicker. It has been observed that the ring of the bell will insure a prompt answer, and for this purpose large extension bells are used, which can be heard several hundred feet away. In the four years that the telephone has been used for dispatching, not a railroad accident has been laid to its door, so that it may be said to be as safe as, if not safer than, the telegraph. Furthermore, it has been made possible to increase the length of a division handled by one dispatcher by as much as 50 per cent.

The personal relationship factor, which is always a thing to be desired, is strengthened by the direct personal communication by word of mouth between the dispatcher and the men under him. Discipline is improved and efficiency increased through the agency of the telephone.

It is not intended in this article to dwell to any extent on the operation of the circuits, but a general statement regarding the working of the new system will not be amiss. The dispatching circuit consists of two wires, and to these are connected the various telephone sets and selectors located at the way stations. When it is desired to call a station, the dispatcher turns a selector key, which, as the name implies, selects only that particular station desired and through the medium of the receiving selector apparatus, rings a bell. When two or more stations are wanted on the line at the same time, the proper number of keys are turned by the dispatcher. Train orders are then communicated verbally by the dispatcher, who writes down the order as he delivers it, in order that it may not be delivered faster than the operators can transcribe it. The message is then repeated back to the dispatcher. All proper names and figures are spelled out as prescribed by the rules of the railroad telegraph associations.

A further feature is that the telephone circuits are so arranged that the superintendent, chief dispatcher, or other road official, can listen in on the line at any time he may desire and inspect the service being given. Such listening-in or observing service sets can be connected to the circuit at any point. Perhaps the greatest advantage in the employment of the railroad telephone is in its use in siding and portable telephone sets. The former may be placed at any interval along the right-of-way, or at stated points, such as long sidings, water tanks and drawbridges. In cases of emergency they are of infinite value, as they permit the train crew to get into touch immediately with headquarters and get new orders. Another type of apparatus which is also valuable in emergencies is the portable telephone set, which is carried on trains and can be connected or hooked on to the overhead circuit by means of jointed line poles at any point on the line. Sets such as these may, when used but once in an emergency, prove of such value that they more than pay for the whole telephone system.

The communications described above are carried over what is known as "train wires," that is to say, wires which are used only for handling train orders. There are, however, two other classes of wires which will show that the telephone serves other purposes and facilitates the general transaction of railroad matters.

The "block wire" is a circuit extending from block tower to block tower, and is of use in permitting the tower men to get into easy and quick communication with each other.

The "message wire" is a circuit over which the railroad transacts its commercial and executive affairs. In fact, when used in connection with a private branch switchboard of a size adequate for any required number of extensions, the railroad has its own telephone system. The advantages of such an installation are incalculable.

While on the subject of circuits, it may not be amiss to mention the "phantom" circuit, which is, in its simplest form, the use of two physical metallic circuits (that is, actual wires) connected in such a way with suitable apparatus, that for purposes of transmission there are three distinct circuits, two physical and one "phantom." It will be seen readily that an arrangement of this character effects a saving in wire and that, to use a homely expression, "Two blades of grass are made to grow where there was one before."

Another circuit, in use where stations are far apart and where it would be an undertaking involving considerable expense to construct new telephone lines, is the "composite" circuit. This simply means that telegraph and telephone messages may be sent over the same wire and at the same time, by adding certain apparatus and changing the line connections somewhat. A comparatively recent achievement, which is of great value in railroad work, has been the compositing of phantom circuits.

The telephone lines which have been and are being installed are built very substantially and consist, in the main, of two copper wires weighing 210 pounds to the mile. The lines range in length from 30 to 400 miles, and practically any desired number of stations can be installed.

It has been mentioned that 87 railroads have adopted the telephone for train dispatching and that these make use of the selective method, employing in all approximately 11,500 selectors at the various way stations. There are, however, a large number of roads not having a length of over thirty miles which use the magneto telephone, with code ringing, for handling trains. When these are added to the others, the aggregate is indeed very large.

A number of roads have their total mileage com-

pletely covered by telephone circuits for dispatching trains, and others are attaining this desirable end as quickly as the necessary appropriations are made. It may also be stated here that the nine-hour law, which was established for telegraph operators, was a factor in getting the railroads to consider the telephone for dispatching work inasmuch as the number of extra telegraphers made necessary by the adoption of the new legislation, was not available. The consensus of opinion among railroad men is that within ten years the telegraph will have been superseded by the telephone for the more efficient dispatching of all railroad business—train dispatching and commercial.

The telephone sets used in the dispatching equipments are of various types. In many cases the well-known, standard desk stands and transmitter arms, equipped with highly efficient transmission instruments, are used. In this connection it should be noted that the degree of efficiency to be obtained by these instruments must necessarily be higher than for those used for ordinary service. This is due to the fact that where on a subscriber's line ordinarily but two parties engage in conversation, on a train dispatcher's line there may be two or fifty on the line at once, so that with ordinary instruments the transmission would be of a very poor quality.

A recent development, one to which the Western Electric Company has given a great deal of attention, is a loud-speaking receiver which will prove a great boon to the railroads. Tests made under the most severe conditions show the articulation to be distinct and the tone of sufficient volume to make it easy for the operator to hear clearly no matter how much noise there may be about.

Frequently special transmitter arms have been designed to meet the special requirements of railroad service. One of the most striking of these is arranged so that when the arm is swung into position before the operator, he needs merely to place his head in position to talk. No further effort is required, as the transmitter and receiver are on a short, adjustable arm affixed to the transmitter arm proper. This does away with the use of a head receiver, and is designed especially for tower service, so that the operator may reach his switches without delay. These arms have been used very successfully wherever installed.

# Of Interest to the Trade

By A. L. Haase

## Book Reviews

A DICTIONARY OF ELECTRICAL ENGINEERING, edited by H. M. Hobart. Writing a dictionary is by no means an easy task, and when a man takes upon himself the duty of corralling all the words used in a great industry, he is certainly entitled to considerable credit.

The work under discussion is really an encyclopedia instead of a dictionary. It appears in two well-bound, half-leather volumes, and in addition to defining electrical terms it includes a wealth of specialized information written by various experts. By taking advantage of the cross-reference feature it would seem that a careful reader might, in many instances, acquaint himself with the principles of particular sections of electrical engineering fully as readily as he could with a series of specialized text books.

The work is English, which will account for the fact that in some cases engineering questions are looked upon from a little different angle from that usual in America.

We note the omission of a few commonly used words. It may be that they were deliberately left out with the intention of making the work purely engineering in nature, and yet it is to be regretted that such terms as *elektron* should not have been discussed.

Published by the Gresham Publishing Company, London. Two volumes; bound in half leather; 648 pages.

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PRACTICAL TELEPHONE HAND-BOOK AND GUIDE TO TELEPHONIC EXCHANGE. By T. S. Baldwin, M. A. In his preface, the author calls attention to the fact that he is not addressing experienced telephone men, but rather those who desire to become better acquainted with the uses and possibilities of this universal instrument. For this reason the book will be of especial value to promoters of rural party lines, because it contains all the arguments that are necessary to show the advantages of the telephone to a farmer.

The chapters on construction and maintenance will be found very useful for instructing telephone repairmen how to locate and remedy faults. Detailed instructions are also given on the use of the telephone.

Frederick J. Drake & Company, 180 pages; cloth bound. Illustrated. $1.00.

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THEORY AND PRACTICE OF TECHNICAL WRITING, by Samuel Chandler Earle. Writing is not an easy task, as any one who has ever done much of it can testify. Consequently, a book which tells how it can be made easier should be thankfully received. In writing a technical article, one will, of course, face many problems similar to those of general composition, but if the engineer turns for suggestions to treatises of a general literary nature, he will find a vast fund of material that he cannot use, and will fail to receive guidance where he most needs it. The engineer makes use of a form of expression no less special than that of the poet or the essayist, and yet heretofore he has been offered no specialized instruction in the use of this form, but has been forced to work out his own literary salvation.

The book under discussion is by no means an elementary work. It does not begin with simple rhetorical forms which gradually increase in difficulty as the end of the book is neared. On the contrary, it assumes that the reader is well grounded in the fundamentals of literary composition and that he desires instruction of a specialized nature. It takes it for granted that it is speaking to an audience of engineers who are eager to know how they can get their ideas on paper in satisfactory form, and it gives them the suggestions they most need.

Like a true engineer, the author carefully divides his subject into its logical parts, each of which is developed in an interesting manner. The first part of the book is a study of the principles of logical structure, while the second part shows how to apply the principles in creative writing. An appendix contains numerous illustrative examples of technical writing which are referred to from time to time in the body of the work.

Throughout the whole book the author shows that he is in close touch with engineering subjects, and that he appreciates the guidance needed by technical writers. This familiarity with the needs of his readers is not surprising when one realizes that he is professor of English in the Engineering School of Tufts College.

Published by The MacMillan Company; 300 pages; bound in cloth. Price, $1.25.

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TELEPHONY.—Works on telephone subjects are by no means rare. In quality they range, as books on every subject do, from bad to excellent. Many different opinions may even be expressed regarding the same book, but a critic is reasonably sure of his ground when he states that the Cyclopedia of Telephony and Telegraphy, as reviewed in these pages some months ago, is, without a doubt, one of the most complete, scholarly and authoritative works on the subject ever published.

It is with similar words of praise that we must greet the appearance of TELEPHONY, for the subject matter of TELEPHONY is, insofar as concerns the telephone, the same as that of the Cyclopedia.

The book— for TELEPHONY is published as a single volume instead of four, as is the Cyclopedia—seems to be designed for what may be called the semi-technical man, the man who, without any desire to become a specialist in any of the numerous branches of telephony, has a sufficient feeling for the engineering problems he encounters in his daily work to want to see them solved, and the reason behind the solution explained. The text is a model of clear-cut conciseness, admirably arranged, and with a wealth of practical illustrations. The amount of pure theory and mathematics which the book contains has been reduced to a minimum, so that while the book is complete, the information it embodies is available even to those who may have forgotten their calculus.

A strict standard of practicability was set up, and the authors have followed it with praiseworthy devotion. Difficult points have not been hurriedly passed over, but have been dealt with in a thorough manner, concrete examples being frequently introduced. Fundamental principles, sub-station equipment, party line systems, protection, switchboards, automatic systems, automanual systems, intercommunicating systems, power plants, special service, construction and maintenance, train dispatching, phantom, simplex and composite circuits, traffic problems—in fact, all the great divisions of the subject are treated with thoroughness.

The authors of the book, Samuel G. McMeen and Kempster B. Miller, are so prominent in the telephone field that they really need no introduction. In TELEPHONY they have produced a work which will be of value to a host of telephone men. It is a good addition to one's equipment.

Published by the American School of Correspondence. Vellum de Luxe, with gold title. 960 pages. Price $4.00.

MODERN AMERICAN TELEPHONY, by Arthur Bessey Smith, is a practical, comprehensive treatise including descriptions of apparatus, construction, maintenance, exchange operation, conduits, cables, sub-stations, switchboards and the central office.

The book is in no sense technical. It is a practical man's book, devoting itself to a straightforward presentation of data and description. The author in his preface expresses a hope that the book will prove of interest and help to the man who "shoots trouble," as well as to those whose duties call them into other relations with the plant, and from the examination we have given the book, we believe it will accomplish this purpose. The subjects of wireless telephony and automatic systems are well treated at considerable length.

Published by Frederick J. Drake & Company; 16 mo.; bound in full limp leather; round corners; red edges; with gold titles; 790 pages. Price, $2.00.

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THE PROPAGATION OF ELECTRIC CURRENT IN TELEPHONE AND TELEGRAPH CONDUCTOR. By J. A. Fleming.

Up to the present there has been no work in which the student or engineer engaged in telegraph or telephone matters could find, in a single volume, a fairly full account of the modern methods of dealing with transmission problems. It was necessary to refer to numerous detached papers, written by investigators on both sides of the Atlantic, and therefore Dr. Fleming deserves the thanks of the telephone engineering profession for the work he has done in collecting the information contained in these scattered papers, and placing it in a readily accessible form.

Knowledge of the use of hyperbolic trigonometry is not yet widely spread among electrical engineers, but since great use is made of this branch of mathematics in modern transmission theory, Dr. Fleming devotes the first chapter of his book to a brief explanation of its fundamental principles. A useful table of hyperbolic functions of imaginary quantities is given at the end of the chapter. The second chapter deals with the propagation of electric waves along conductors. The reflection phenomena which occur at the ends of a circuit are discussed, and the chapter concludes with an investigation into the attenuation and wave-length constants of a line. In Chapter III the theory of the propagation of simple periodic currents along a telephone loop is worked out. The three cases of a loop disconnected at the distant end, short-circuited at the distant end, and with the distant end closed through a receiving instrument, are separately considered, and the formulæ giving the current and voltage in different portions of the circuit under these different conditions are obtained. The fourth chapter deals with the question of the propagation of actual telephonic speech waves over a loop, and discusses the various methods which have been proposed for improving the quality of transmission over a telephone circuit. In the fifth chapter the theory of the transmission of signals over a submarine cable is worked out, and the method of improving the speed of signaling by means of curb-sending is explained. Chapter VI deals with the special case of the propagation of high-frequency currents, such as those used in wireless telegraphy, and also with the case of the transmission of currents of very low frequency, or of continuous currents, over leaky lines. In Chapter VII are given the methods used for actually measuring the constants of cables, in order that the formulæ obtained in the previous chapters may

be put to practical use. The eighth chapter deals with the application to practical cases of the theory previously given, and shows how nearly the results obtained by actual measurement agree with those obtained by calculation. In the last chapter the methods employed in present-day practice for improving transmission over telephone circuits, aerial, underground, and submarine, are described. The book concludes with a table of hyperbolic functions of angles from 0 up to 7.5 radians.

The subject of transmission has been treated in all its aspects, and after working through this book, the student should have a good all-round grasp of this branch of applied electricity. Unfortunately, however, there are a number of errors in the book. The argument is somewhat obscure in several places. It would appear as if the book had been prepared very hurriedly for the press, and that sufficient care had not been given to the correction of the proofs, so that the slips mentioned have been overlooked. Doubtless, in subsequent editions, the necessary corrections will be made.

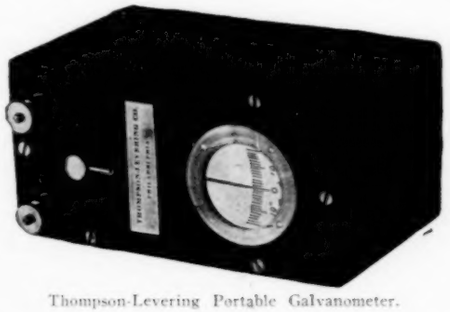
Published by D. Van Nostrand & Company, New York. Three hundred sixteen pages. Price, $3.

## A T-L Portable Galvanometer

One of the biggest features of the T-L instrument is its portability, combined with unusual high sensibility. The way this instrument is designed makes it able to stand as rough usage as the ordinary voltmeter. Its high sensibility makes it possible to use this instrument where it was formerly necessary to use the non-portable suspended coil galvanometer.

The instrument is built strongly, being capable of withstanding as rough usage as an ordinary voltmeter. The system is of the well-known D'Arsonval permanent magnet type, the magnet being of the finest grade of special magnet steel, carefully aged, and is guaranteed permanent and strong.

The binding posts are large and substantial. The instrument is provided with a zero adjustment, which is quick and positive in its action, and is entirely mag-



Thompson-Levering Portable Galvanometer.

netic control. This galvanometer is extremely valuable to use in connection with all Wheatstone bridge measurements, and will easily show a variation of less than 1/10 of 1 per cent in the resistance measured. It is adapted for the checking of voltmeters or ammeters to a very close accuracy by the potentiometer method. The case is of polished mahogany, and the brass parts are highly polished and lacquered, and the finish throughout is substantial and strong.

The current from one volt, through a resistance of 750,000 ohms, will cause the pointer to move one millimeter division over the scale. The scale is well lighted and easily read, is uniform throughout, with 30 millimeter divisions, 15 each side of the center zero. The scale is calibrated so that the divisions are proportional to the current, something which is not usually furnished without extra charge in an inexpensive instrument. The overall dimensions are 3 inches wide, 3¾ inches high, and 6 inches long.

The manufacturer, Thompson Levering Company, 244 Arch street, Philadelphia, will send a detailed description and prices on request.

The Thompson-Levering Company reports a steadily increasing demand for Peerless instruments.

Although a comparatively new company, as years go, the excellence of these various types of instruments has given them a mighty strong place in the minds of buyers of electrical testing instruments, and no large company or consulting engineer thinks of buying without inspecting the company's product.

Older companies which have had the advantage of seeing their instruments in use and under analysis by the large engineering student bodies for past years, would be expected to reap the orders from those engineers, who, graduating, have positions of worth and would naturally buy the type of instrument with which their school practice had made them familiar; but the extreme care taken in the manufacture of Peerless instruments and the accuracy insisted on by the manufacturers has decided quite a number of critical buyers to patronize this younger firm and with good satisfaction to themselves.

Contrary to the popular opinion that every one is willing to assist a new company it is in general practice the custom to make a firm age before patronizing it, and the success of this company in the past few years can be ascribed to the sheer merit of its product.

At present the company is making electrical testing sets, condensers, A. C. and D. C. meters, galvanometers, pyrometers, rail-bond testers, photometers, tachometers and thermometers. While years of experience in designing and manufacturing with older companies fit the director of the company to devise special apparatus of any type, they have made instruments both special and standard for such critical buyers as the Western Union Telegraph Company, the Pennsylvania Railroad Company, the Bell Telephone Company, the United States Navy, and the largest independent telephone company, the Keystone Telephone Company at Philadelphia.

## Restoration of Service in 98 Hours

The Missouri and Kansas Telephone Company's Fairmount exchange at Kansas City, Missouri, was completely destroyed on Sunday, October 22, at 3 a. m., by a fire which is believed to have been caused by an explosion of gas in the house adjoining that in which the central office was located. The telephone company at once communicated with the Western Electric Company and the work of restoring service to the subscribers was begun at 9:00 o'clock of the same morning, when a dozen men from the electric company's local installing force appeared upon the scene.

The Hawthorne factory of the Western Electric Company was called upon by long distance telephone to make a hurry-up shipment, and responded by sending forward the necessary apparatus by express the evening of the day on which the fire occurred, thus supplementing without delay the work which was being done by the

local house in rushing material to the building in which the new exchange was to be housed.

The new switchboard equipment consisted of several sections from the telephone company's stock, and some from an addition which was to be installed at the Rosedale exchange, on account of the increasing business in that district. Twenty-six installers reported for work on Monday morning, October 23, and from that time until the new board was cut in service at 5 a. m., October 26, with a full equipment of 800 subscribers' lines, a day and night crew were at work continuously.

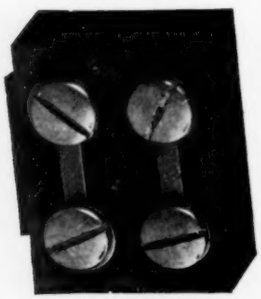
Taking into consideration the fact that the work was done under high speed conditions, in order that the subscribers might not be inconvenienced for an extended period, it is of worthy note that the trouble reports issued as a matter of routine by the telephone company indicate that the work of the Western Electric Company's installing force was so well done that a minimum of trouble was experienced after the new equipment was cut into service.

## Rifle as Lineman's Tool

A lineman in the employ of the Puget Sound Electric Company has demonstrated that a rifle is a necessary part of a trouble-shooter's equipment. A toppling pole, too dangerous to climb, threatened to pull down the high-tension wires. The lineman, perhaps mindful of similar depredations of the small boy with his gun, shot away the insulators on the damaged pole and thereby released the line so that the pole could be pulled down without damage.

## Interlocking Connection Blocks

Practical scientific management, applied to constructional problems of all types, has proved and emphasized the tremendous economic value of standardizing related components. This truth is being utilized in modern practice, to the formerly neglected details, and the application has resulted in more uniform construction, in perfected methods, and in no inconsiderable financial saving. As a type of detail standardization, particularly applicable to the great telephone and telegraph industries, the interlocking connection blocks, here illustrated, may be cited.



Unit Connection Block.

In the distribution or connection of multiple telephone or telegraph circuits, it has been the custom to use terminal strips of various designs, each fitted with devices permitting the attachment of several circuit pairs. These odd-size strips were required to serve in all cases, irrespective of the number of pair connections actually needed in a particular instance.

The interlocking connection block system essentially differs from the older method, in that it is based upon a standard unit. A series of unit blocks, held in strip form by occasional screws and the interlocking projections and recesses of the blocks themselves, makes up a connection strip giving the precise number of pair connectors required.

Certain advantages of such a method are clear upon a moment's thought. In the first place, the necessity for carrying odd sizes of connection strips in stock is eliminated. Given a supply of units, with fittings suited to the connection methods of the company using them, every installation, large or small, may be definitely planned and executed, with standard stock material. Moreover, the system permits precise planning to the exact number of pairs, with the possibility of increase or decrease to any degree instantly avail-

Connection Strip Made Up of Interlocking Units.

able. Briefly, the method possesses the advantages of unit form, simple combination, ready expansion or reduction, and economical planning.

These interlocking connection blocks are manufactured by the William J. Murdock Company, Chelsea, Mass., who will gladly send samples and descriptive folders upon request.

## Pointers on Buying Motor Wagons

How to choose a motor truck or delivery wagon without making a costly mistake is a problem that confronts thousands of concerns. They have practically decided to adopt motor vehicles to facilitate their business, being convinced by observation and foresight that the mechanical road vehicle is inevitable to continued industrial and commercial progress. But, while qualified to buy horses and wagons suited to the conditions of their business, the motor wagon is such an unknown quantity to them that many are more or less at sea regarding the steps to be taken and the points to consider.

With well over one hundred different makes in the market to choose from, and every possible size and type, what the prospective buyer is in need of is more knowledge on the subject.

The obvious thing is to get in touch with those who do know about the machines and to make as careful a study as possible of the different kinds and sizes and their respective merits and capabilities. It is essential to the satisfactory use of a motor truck or delivery wagon that it be suited in all respects to the precise nature and volume of the work to be done, roads or streets to be traversed, topography of the vicinity where used, daily mileage required, and amount of care likely to be bestowed upon it on the road and in the garage.

By far the greatest educational factor is the big national motor car shows, at which all the principal makes of trucks and delivery wagons can be examined and compared as to design, workmanship and price. There the experts, not of one or two, but of a dozen or more companies, may be consulted without establishing an implied obligation to buy from any company that confers the favor of such advice. It will be possible in one or two day's time to gather information at the shows that would require months of effort to acquire in any other way. Nearly seventy different makes of business vehicles will be on exhibition in New York

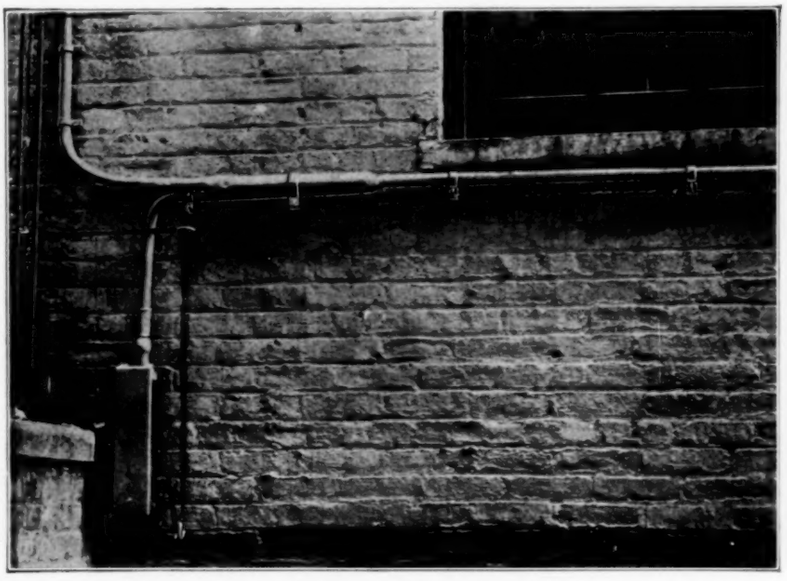
from January 10 to 17, and an equal number in Chicago from February 5 to 10. In all, fully ninety different companies will display their newest models this winter, among which will be many never before in the market.

## Interior Block Distribution

In abandoning the use of unsightly pole lines in the larger cities, it became necessary to devise some means for distributing telephone service from the central station to the offices, stores and residences of subscribers. The most approved system that has been adopted for accomplishing this purpose is that known as "interior block distribution." In this form of construction, the cable is introduced into the interior of the city block, preferably at one end, is taken from the subway and carried along in diminishing pair cables and attached to the rear fences or walls of the buildings.

Terminal boxes are located at convenient points and the smaller cable run from one terminal box to the next. This cable usually contains from 50 to 100 per cent more conductors than are required at the time of installation. By this method a number of telephones in use can be supplied and the surplus of conductors for future business obtained at less cost than the former method of running additional bridle wires whenever a new telephone is installed. This, however, does not entirely eliminate the use of bridle wires, it being often necessary to parallel the run of cable with one or more bridle wires for a short distance in order to connect the telephone to the nearest terminal box.

The Diamond Expansion Bolt Company, 90 West street, New York, has devised, patented and marketed an attachment, which with one fastening will support the lead cable and bridle wires paralleling the cable. This is done by means of a clamp called the "Long Saut" cable clamp, very similar to half a pipe strap bent back on itself, made of soft steel with round edges and provided with two holes, one for a word screw or expansion bolt used interchangeably when fastened either to brick or wood. The other hole is tapped 10/24 machine thread in which a brass or galvanized bridle ring can be screwed either at the point the cable is put up or at any later date when bridle wires are to be run parallel to the cable. As a matter of economy it is often found that a fifty pair cable will cost less per foot than fifty twisted pair bridle wires strung along bridle rings and then radiating to various points where telephones are installed.

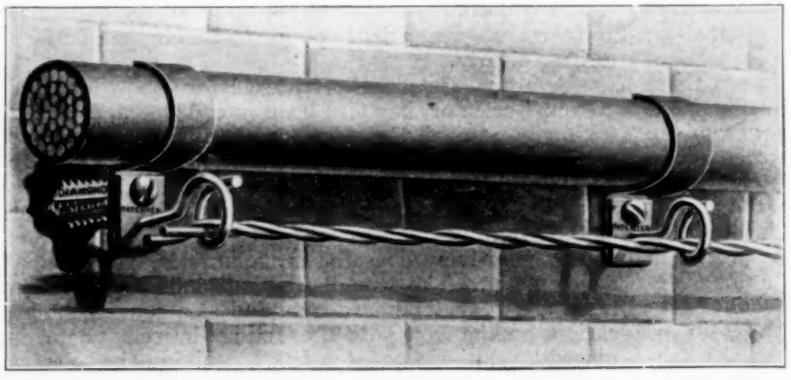


Terminal Boxes and Parallel Runs of Lead Cable and Bridle Wire Supported by "Long Saut" Cable Clamps in Interior Block Distribution.

Wood plugs have been used heretofore with malleable iron spike dogs driven in to hold cable in place, and where bridle rings are necessary to string parallel runs of bridle wire, separate holes were drilled, plugged with wood and rings driven in. The objectionable features of this class of construction are, that the wood plugs will deteriorate and rot out in a few years, the spike dog driven against the cable will injure the lead sheathing, additional expense is incurred by drilling larger holes than required for expansion shields, and the additional drilling is needed for bridle rings.

With the "Long Saut" cable clamp these difficulties are eliminated. The Diamond expansion shields properly screwed will hold as long as the wall lasts, require a much smaller hole, and the cable clamps are formed to suit the various diameters of lead cables, and will not injure the lead sheathing. After the clamps are attached no further drilling is necessary. When necessity arises, parallel runs of bridle wires are run next to the cable by screwing bridle rings into the clamps without any additional drilling. These items comprise a considerable saving in the construction of telephone plants and will more than off-set the increased cost of the clamps.

The telephone companies in New York, Chicago, San Francisco and Baltimore that are being reconstructed are using exclusively "Long Saut" cable clamps and Diamond expansion shields,



Method of Attaching Lead Cable and Parallel Runs of Bridle Wire with "Long Saut" Cable Clamps.

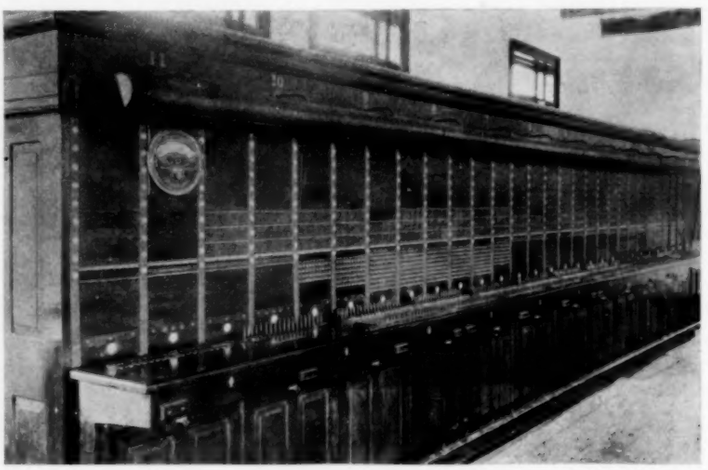
## Installation at La Porte, Indiana

The La Porte (Indiana) Telephone Company is arranging for the early installation of a new central office equipment, which is to be built in accordance with the most recent developments in that line. The new switchboard and its accessories are to be furnished by the Western Electric Company and represent the best and latest developments in the art of telephone engineering. All the telephone sets which will be required for the use of subscribers are also to be purchased from the company. The equipment is to be of the central battery, lamp signal type, which is recognized as the standard for telephone offices of this size, and consists of five switchboard sections of the type illustrated in the accompanying photograph, having a present capacity of fifteen operators and equipped for 1,400 city subscribers' lines and fifty rural lines, as well as the necessary frames, racks, desks and power plant. Provision is made so that three more sections of switchboard may be added at any time to take care of business increases. This installation will mean the best of telephone service in the city, as the type of equipment to be used is designed for the smooth, accurate and prompt answering of calls.

The LaPorte Telephone Company has also deemed it advisable to provide a housing for this new equipment which will be commensurate with the steady growth of LaPorte and adapted to the use of both the executive and operating forces. The building which is intended to be completed by March 1, 1912, when the switchboard will be ready for service, will represent a cost of approximately $30,000 and will be located at 805 Indiana avenue. It is designed to be of reinforced concrete construction, absolutely fireproof throughout, and will have the front and side walls faced with brick, with sandstone trimmings. The first floor will be devoted to the private offices of the president and secretary and the offices of the bookkeeper and cashier. The terminal room, containing the frames, racks, power plant and wire chief's desk, will also occupy a part of this floor. The second floor will contain the operating room, as well as a rest room for the operators, lockers and kitchenette.

A short description of the working of the central battery equipment may not be amiss and the following will give an idea of the distinct advantages connected with its use. The circuit features of the new switchboard take care of the various steps in a manner that leaves very little manual work to be done by the operator, thus practically eliminating the personal equation. With the common or central battery telephones there is no cranking or ringing of bells at the calling station. When the subscriber lifts the receiver from the hook he performs a manual act, one that is necessary in every system. Removing the receiver automatically causes a tiny electric lamp to light up before the central office operator, who then inserts a plug into a jack which is directly below the lamp. The operator then works her listening key and ascertains the number desired. With another plug-tipped cord she connects to the called-for subscriber. This causes a train of automatic operations to take place, and then the subscriber's bell is rung. He lifts his receiver from the hook, and this automatically notifies the operator by means of a further light signal that he is at the telephone.

The reverse of all this takes place when the disconnection is made. The subscribers hanging the receivers on their respective hooks after completing their conversation, set in motion a train of operations whereby the operator, without listening in upon the line or asking the subscribers if they are through talking, may determine at a glance that the conversation is finished, and the simple operation of withdrawing the plugs and allowing them to fall into their positions restores the lines to their original condition, ready to take care of the next call with the same expediency.



Type of Switchboard to Be Used at La Porte, Ind.

## Western Electric Developments

During the past year the Western Electric Company has contributed to the world its full quota of new developments in the fields which have made it famous, and, in effecting innumerable improvements in existing types of apparatus, has more than kept abreast of the march of progress. In telephone apparatus work, the following represent some of the most noteworthy achievements:

*Railway Train Dispatching.*—The Western Electric loud speaking receiver has been perfected and placed upon the market. This receiver is intended for use mainly in block towers, and tests made under the most severe conditions, show the articulation to be distinct and the tone of sufficient volume to enable the operator to hear clearly.

A new Western Electric selector, known as the "Group" selector, has also been introduced and placed with a great deal of success on the lines of a number of railroads. It is designed so that the dispatcher, by operating his selector key first, picks out automatically a group of five selectors and then a particular selector of the group.

A selectively operated semaphore is another new development. The semaphore blade and spectacle segment are of the standard type and at a convenient location, on the iron post supporting the semaphore, is placed a weatherproof iron box containing the selector set and telephone equipment. This enables the train dispatcher to throw the semaphore and communicate

with the train crew when the train gets into the block. By means of an answer-back signal, the dispatcher is informed absolutely if the semaphore has operated. The apparatus contained in the selector and the telephone box is of the standard Western Electric type now so widely used.

*Inter-communicating.*—The Western Electric has developed an application of its well-known "Interphones" to the needs of apartment houses. For the suites, Inter-phones of the flush or non-flush, metal or wooden types are used. The line is complete, including sets for the vestibules and for the use of janitors and tradesmen. A new wooden type "Inter-phone" telephone set has been placed upon the market. It differs from the wooden type formerly furnished in that it contains a key so designed that the selecting and ringing of the called station is accomplished in one operation, thus obviating the necessity for a separate ringing button. The cabling is also made more accessible as the wires go direct to the apparatus instead of the backboard. Another development which will be of value in Inter-phone installations is the new type of cable terminal (No. 19), which has recently been placed on the market, and is so designed that all connections may be made by means of a screw driver. There are no soldering connections and the terminals will accommodate as many as four cables. It is furnished in several sizes and is adapted to all classes of interior work. A green glazed cotton covered "Inter-phone" cable has also been developed for use where the cable must be run in exposed places.

*Switchboards.*—Following upon the great success met with in the introduction of the No. 1800 type sectional unit switchboard, it has been found advisable to place upon the market a further development of the unit switchboard idea for use in hotels, clubs, schools and manufacturing establishments. This is an adaptation of the familiar unit sectional book-case to telephone use and in a like manner may be added to at any time when it is found necessary to increase the number of extensions. It is known as the No. 1801 switchboard and may be furnished arranged for non-intercommunicating, intercommunicating or for intercommunicating and private branch service. It also contains a novel fire alarm feature by means of which all extensions may be notified of a fire at the same time.

A new Western Electric switchboard, known as the No. 1013 and of the magneto multiple type, has been introduced and is designed for serving from 250 to 1,500 lines. It has been developed for use where conditions do not make for a common battery system, and contains among other features, a jack for every line within the reach of each operator.

There has also been placed upon the market a new multiple convertible switchboard—the No. 1014—arranged so that any number of lines can be converted from magneto to common battery service whenever desired. This board is also designed for serving from 250 to 1,500 lines.

For exchanges where a wire chief's testing cabinet would not be large enough and the standard wire chief's desk too expensive the No. 1309-C wire chief's turret has been designed. This is self-contained and of the cordless type and may be placed in any convenient place, such as a table or flat topped desk.

*Miscellaneous.*—A vacuum lightning arrestor, designed primarily for railroad telephone equipments, has been introduced and is meeting with much favor wherever used, on account of its very low maintenance cost and high efficiency.

A new central battery series telephone set, with specially designed transmitter and receiver, fills a long felt want for an inexpensive set to be used on short lines where, for all practical purposes, it will give as good service as a set with an induction coil. The set may be used interchangeably with regular common battery sets on all common battery lines.

Unit type distributing frames for common battery multiple switchboard installations have been developed. These may be added to as the need for additional equipment becomes apparent and they are so designed that a considerable saving is effected in cabling.

Other developments of equal importance are switchboard lamps having the end of the glass bulb made into a lens to intensify the light; a new and improved tinsel cord developed after considerable research work, having a longer life and making for better transmission than has heretofore developed; and new switchboard keys to be used in connection with harmonic ringing systems. The latter are very compact in construction and have a locking feature showing which ringing button was used last.

## Foreign Opportunity

An American consul reports that the board of directors of a telephone company in his district intend to erect a modern telephone station and to install a new system that will accommodate 10,000 subscribers. The board is undecided as yet which system to adopt, whether to continue the present switchboard system or substitute the automatic. The consulate has reliable information that no decision will be made in the matter until a commission, now on a tour of inspection in the United States, has made its report and findings, and, furthermore, that the installation will not take place within a year. There will be ample time for American firms desiring to compete for this business to investigate the matter in detail, and the consulate will be at their service at any time to aid in such investigation. English may be employed in correspondence.

Full details can be obtained by writing the Bureau of Manufactures, Washington, D. C., mentioning No. 7,645.

An American consul in a Latin-American country reports that the local government has appointed an engineer to prepare the preliminary plans for a government telephone system for a certain city. The engineer requests catalogs, with prices, of telephone material of every class. The consul requests that American firms send him the necessary information as soon as possible. His name will be furnished by writing to the Bureau of Manufacturers, Washington, D. C., and mentioning file No. 7736.

An American consul in the Near East reports that a leading importer of his district desires to be put in touch with American manufacturers of telephone appliances, electric bells and accessories, desiring also instructions for the installation thereof. Correspondence with the inquirer should be in French. His address will be furnished by addressing Bureau of Manu-

factures, Washington, D. C., referring to Inquiry No. 7798.

The Post and Telegraph Department, Paris, France, will receive bids for the installation of a multiple switchboard for Marcadet telephone office until January 15, 1912, but tenders will be received only through local agents. Full information will be furnished by referring to Inquiry No. 7811, at the Bureau of Manufactures, Washington, D. C.

### Chase Motor Truck Company Busy

The Chase Motor Truck Sales Company, Minneapolis, Minn., has just taken the agency of the Chase Motor Truck Company, Syracuse, N. Y. This new agency gets an unusually attractive territory which includes the entire state of Minnesota, also North and South Dakota and a small portion of Wisconsin. It starts off with an initial order for 23 trucks for immediate delivery.

The Chase Company has issued a handsome folder describing the new Chase surreys, two and four passenger. They are built to stand rough use and to run through mud and snow and over bad roads. Solid tires are used, and an air-cooled three cylinder two-cycle engine of 20 horse-power. This car appears to be just the thing for telephone managers.

### Mines Must Have Telephones

The last Kansas legislature enacted a law providing for a complete telephone system in each mine in that state.

Recently a cavein occurred in a mine in southeastern Kansas, and the men who were imprisoned in the mine communicated with the officers and directed the rescue work, so that all were saved without loss of time.

As a safety appliance it is obvious that a telephone has great advantages over an air tube or pounding signals on an iron pipe.

### Toll Ruling of Kansas Commission

The ruling of the Public Utilities Commission which is creating such a disturbance among the telephone subscribers in Shawnee county, Kansas, prohibits a telephone company from charging a greater rate for toll service to non-subscribers than is charged to subscribers. Previous to this ruling farmers near Topeka had been paying a stipulated amount for telephone service with unlimited toll service into Topeka. Under the ruling of the commission this is prohibited.

### Testing New Telephone Law

The state railway commission of Wisconsin, has begun the hearing in the case of Winter versus the Wisconsin Telephone company and the La Crosse Telephone Company, to compel them to give joint service under the physical connection law, passed at the last session of the legislature. Both companies are resisting. The decision will affect all Wisconsin cities having more than a single telephone company.

A very attractive and useful souvenir is being passed around by the American Cross Arm Company, Chicago. It is a miniature cross-arm of Washington fir, just ten inches long. On one's desk it serves as a paper weight, straight edge, pencil holder and constant reminder of the old days on the line. Telephone Engineer readers can secure one apiece by writing the Company.

A handy device is being offered by Mathias Klein and Sons in the shape of a wire skinner. It skins or splits any kind of insulation wires of all sizes, and is far superior to a knife for that purpose. It is small enough for any pocket, sells for a popular price, and should be included in the kit of every workman.

Literature recently received from W. N. Matthews & Brother, St. Louis, describes some more methods of anchoring under difficulties with the Matthews guy anchor, the 2-bolt guy clamps, the Matthews' cable clip, the Telafault, anchor wrenches, lamp changers and trolley sleet cutters.

For a number of the cuts appearing in the article last month on "Underground Telephone Construction" we are indebted to the Safety Insulated Wire and Cable Company, 114 Liberty street, New York, which was kind enough to supply us with these interesting views of conduit construction.

# Brevities of the Business

*CONVENTIONS.*

The National Independent Telephone Association will hold its annual convention in Chicago February 7, 8 and 9, 1912.

The annual convention of the Minnesota Independent Telephone Association will be held in St. Paul January 23. A fine program is being prepared and an interesting and profitable session is anticipated. Lucius D. Clark is president of the association.

The Western Pennsylvania Independent Telephone Association will hold its third annual convention in Hotel Antler, Pittsburg, January 18 and 19, 1912. A strong program will be provided and an interesting exhibit is being planned.

*PERSONAL NOTES.*

Arthur E. Case, chief engineer for the Baird Electric Company, Chicago, has been elected an associate member of the American Institute of Electrical Engineers.

William J. Mitchell has been appointed manager of the Bell Telephone Company's exchange at Utica, N. Y. Mr. Mitchell is succeeded in his former position by W. F. McMahon, of Cortland, who will have charge of both the Cortland and Ithaca exchanges.

Harry O. Wright is the new manager of the Citizens' Independent Telephone Company, New Lexington, Ohio.

Frederick A. Phillips, manager of the Lynn telephone exchange of the New England Telephone and Telegraph Company of Boston, has been promoted to the position of commercial manager of the Lynn district, which includes Lynn, Saugus and Nahant.

Russell B. Smith, Batavia, N. Y., has been appointed manager of the Black River Telephone Company, succeeding George M. Box.

James H. Shoemaker, general manager of the Corn Belt Telephone, Waterloo, Iowa, has resigned his position and will engage in a different line of business.

Daniel Carroll Hemingray, secretary and treasurer of the Hemingray Glass Company, Covington, Ky., died December 14 at the age of 54 years. He was stricken with paralysis on the afternoon of the 12th while in his automobile on the way from the company's offices to his home in Glendale, Ohio. He was taken to the Queen City club and died there. "Dan" Hemingray was one of Cincinnati's best known business men, and had a host of close friends. Besides his interest in the glass company, he was a director of the Cincinnati Trust Company and the Suspension Bridge Company. He was the son of Robert Hemingray of Covington, who founded the Hemingray glass business more than half a century ago. He was educated at the Chickering institute and at Boston "Tech" and entered his father's business, becoming a traveling salesman. He proved very successful on the road, his amiable nature winning him friends everywhere. He was a member of the Queen City Club, Business Men's Club, University Club, Country Club, the golf clubs, and was a non-resident member of many of the leading clubs throughout the country, his business having led to his wide acquaintaceship. Mr. Hemingray married Clara Keck, daughter of the late "Si" Keck, and she survives him. His brother, Ralph G. Hemingray, is president of the glass company and makes his home at Muncie, Ind., where the factory is located. Mrs. Bradford Shinkle of Covington and Mrs. W. H. Felix of Lexington, wife of the Rev. W. H. Felix, are surviving sisters.

E. C. Norton, vice president of the Northwestern Cedarmen's Association, died September 9 at Escanaba, Mich., at the age of 36. He was born at Burlington, Wis., In 1898 he became cedar inspector for the Kinlock Telephone Company of St. Louis, being stationed at Escanaba. Here he organized an inspection bureau, serving several telephone companies. The Kellogg Switchboard and Supply Company next engaged him until 1908, when he established a pole and logging business of his own. A wife and two daughters survive him.

J. P. Boylan, consulting telephone engineer of Cleveland, Ohio, visited the offices of TELEPHONE ENGINEER last week on his way to Galesburg, Ill., where he is working in the interests of the North Electric Company. An automanual system has been installed at Galesburg which will be described in an early number.

John Mills, of the engineering department of the American Telephone and Telegraph Company, New York, was elected an associate member of the American Institute of Electrical Engineers at a recent meeting of the directors.

S. D. Levings has resigned his position with the Waterbury Company, of New York City, and will take a position with a large exporting concern.

Joseph M. Locke has resigned his position as wire chief for the East Tennessee Telephone Company, Bowling Green, Ky., to accept the management of the Home Telephone Company of that city.

L. F. Waller, of Saginaw, has been appointed superintendent of the Michigan State Telephone Company at Detroit, to succeed J. E. Scott, who has been transferred to the office of the superintendent of traffic in Detroit.

Z. A. Kimbro, of Enterprise, La., has been appointed manager of the Cumberland Telephone and Telegraph Company at New Orleans, succeeding J. W. Martin.

C. R. Lose, Williamsport, Pa., has been appointed general manager of the Coudersport district of the Bell Telephone Company, to succeed C. E. Lovell.

W. W. Culbertson has been appointed local manager of the Pacific Telephone and Telegraph Company's interests at Escondido, Cal.

S. T. Brown, of Oakland, Cal., has been appointed district manager for the Pacific Telephone and Telegraph Company at Livermore, to succeed Frank Lake, who has been transferred to the Oakland office.

G. A. Taffwater, Helena, Mont., will have charge of the telephone exchange at Loveland, Cal., succeeding W. H. Trimble, who has been transferred to Cripple Creek, Colo.

Calvin B. Burch has been transferred from the management of the Penn Yan exchange of the New York Telephone Company to a similar position in the company's exchange at Elmira.

Henry Matthews, Philadelphia, Pa., has been appointed manager of the Chester district of the Bell Telephone Company, succeeding William P. Hull, who has assumed the position of district manager for the company, with headquarters at Germantown.

S. G. McMeen was recently elected president of the Mount Hood Railway Company of Portland, Oregon.

C. H. Hubbell has been appointed superintendent of telegraph of the Rock Island System, succeeding the late G. S. Jennings.

Alonzo Burt, vice-president and treasurer of the Chicago Telephone Company, has been elected a director of the company, succeeding Angus S. Hibbard, resigned.

W. W. Culbertson has been appointed local manager of the Pacific Telephone and Telegraph Company's exchange at Escondido.

John A. Kick, well known to TELEPHONE ENGINEER readers, has been suffering from a long attack of typhoid fever, but we are glad to announce that he has recovered and is "back on the job."

John B. Doolittle, for years district wire chief of the Missouri and Kansas Telephone Company, has been made superintendent of plant at Hannibal, Mo., this being a new department, just established. Frank Lathrop, the present district manager, will continue in charge of the commercial and traffic departments and the plant department will be under Mr. Doolittle, who will have charge of all engineering, construction and maintenance. O. B. Bourne will succeed Mr. Doolittle as wire chief.

## *NEW TELEPHONE COMPANIES.*

PORTERSVILLE, CAL.—The Rosedale Rural Telephone Company has been incorporated with the following officers; President, A. Chalmers; vice-president, E. O. Giddings; secretary and treasurer, J. E. Reilly. It is the purpose of the company to install a system connecting the various orange groves in this vicinity with Portersville.

SANTA ROSA, CAL.—The California Telephone and Light Company, a $10,000,000 concern, with principal place of business in Santa Rosa, has filed articles of incorporation with the Secretary of State. The board of directors and incorporators are as follows: John E. Bennett, Palo Alto; F. L. Wright, Santa Rosa; A. H. Spurr and M. S. Sayre, Lakeport; S. Pickerin, Santa Rosa; H. L. Ney, Kellogg. The cost of filing the articles was $1,194. One of the objects of the company is the acquisition of telephone and power lines.

DELANO, CAL.—The Delano-Linn's Valley Telephone Company has been incorporated with a capital stock of $10,000, by Ben Thomas, J. C. Rutledge, A. Villard, P. Girard and R. W. Lockridge.

LINDSAY, CAL.—For the purpose of taking over the local telephone plant, the Home Telephone Company has been organized at this place, with the following officers: President, G. C. Harris, of Tulare; secretary, Lawton Thomas, of Fresno; general manager, A. M. Robertson, of Visalia. The company announces that it will expend about $4,000 in improvements.

STETTLER, ALTA., CAN.—The Prairie Center Farmers' Telephone Company has been organized.

SHAWVILLE, QUEBEC, CAN.—The Pontiac Rural Telephone Company, Limited, has been incorporated with a capital stock of $50,000. The company will construct lines to Portage Du Fort, Bryson, Calumet Island, Campbell's Bay, Fort Coulonge, Chapeau, Otter Lake, Ladysmith, North Bristol, North Onslow, Quyon, Elmside, Bristol and intermediate points.

TROY, IDAHO.—The Nora Farmers' Rural Telephone Company has been organized by A. F. Weeks and others.

OLGA, ILL.—The Olga Telephone Company has been incorporated with a capital stock of $2,500 by Elwood Barker, S. E. Flannigan, Jr., and Lawrence Smith.

ROCHELLE, ILL.—The Rock River Telephone Company is the name of the new company formed by the merger of the Ogle County Telephone Company and the Oregon Mutual Telephone Company. The company has exchanges in Rochelle, Oregon, Forreston, Mt. Morris, Polo, Lindenwood, Steward, and including its own telephone list and its connections with other companies, has over 4,000 telephones in Ogle county, 275 miles of toll lines and 800 miles of farm lines.

WARREN, ILL.—The Warren Mutual Telephone Company has been incorporated with a capital stock of $2,500 by Elmer E. Rose, Everett E. Marsh and M. F. Schryver.

FOREST CITY, IA.—The Coon Grove Telephone Company has been incorporated with a capital stock of $2,000 by O. R. Sveen, H. H. Eichorn and others.

College Springs, Ia.—The College Springs Mutual Telephone Company has been incorporated with a capital stock of $10,000 by J. W. Gibson, Ira Mitchell, A. M. Finley, G. N. Trimble and Elmas James.

Petersburg, Ill.—The People's Telephone Company of Menard county has been incorporated with a capital stock of $100,000 and the officers are as follows: President, Henry H. Colby, Petersburg; treasurer, D. W. Frackelton, Petersburg; secretary, C. H. Rottger, Springfield.

Wiota, Ia.—Articles of incorporation have been filed for the Wiota Telephone Company with the following officers: President, R. R. Bell; vice-president, T. E. Ostrus; secretary and treasurer, D. R. Love.

Abilene, Kan.—The Abilene Telephone Company has been incorporated with a capital stock of $500,000 by A. T. Rodgers, W. W. Dillworth, C. L. Brown, of Beloit; G. A. Rodgers, Abilene and J. W. Smith, Minneapolis. The company operates exchanges at Abilene, Beloit, Concordia and Minneapolis.

Short Creek, Ky.—The Short Creek Mutual Telephone Company has been incorporated with a capital stock of $2,000 by D. M. Young, D. R. Young, S. T. Pryer, Isaac Ferry, S. H. Day, Willie Spurrier, John Bradshaw, J. M. White, S. J. Butler, Irvin Patterson and others.

DeQuincy, La.—The DeQuincy Telephone Company has been incorporated with a capital stock of $10,000 and the officers are as follows: President, J. M. Newhouse; vice-president, J. H. Geldwell; secretary and treasurer, W. R. Watkins.

Daggett, Mich.—Devils Creek Telephone Company has been organized with the following officers: President, Robert Plutchak; treasurer, Albert Engel; secretary, Henry Lucke.

Tryfant, Mich.—The Tryfant Long Distance Telephone Company has been incorporated by H. P. Frantsen, J. P. Paulsen, C. Jensen and others.

North Branch, Minn.—Farmers in this vicinity have organized the Ideal Telephone Company, with John Waldhoff president and Theodore Thompson, secretary and treasurer.

Wagon Mound, N. Mex.—The Ranchers Telephone Company has been incorporated with a capital stock of $3,000 by R. K. Odell, S. M. Reiland, S. A. Foutz and A. Urbahns, of Wagon Mound, and J. P. Vanhouten, of Shoemaker.

Sinclairville, N. Y.—The Central Chautauqua Telephone Company has been incorporated by O. M. Cleland, F. A. Ferguson, Ernest F. Irwin, John G. Rose and May Cross, of Sinclairville, and William Hodge, Gerry Rees and Charles T. Rees, of Akron.

Gwinner, N. Dak.—The Forman, Rutland and Havana Telephone Company has been incorporated with a capital stock of $10,000 by John Powers, Havana; A. E. Land and H. O. Gardner, of Foreman.

Parkham, Okla.—The Parkham Telephone Company has been incorporated with a capital stock of $5,000 by Thos. E. Burton, Frank R. Clark, C. H. Kratz and William Davis, all of Parkham.

Waukomis, Okla.—The Independent Telephone Company has been organized in this place and it is planned to either purchase the present system or install a new exchange.

Romulus, Okla.—Articles of incorporation have been filed for the Romulus Rural Telephone Company with a capital stock of $1,500. The incorporators are G. W. Polk, A. N. Brown, McComb; W. L. Werrell, Romulus.

Uniontown, Pa.—The Tri-State Telegraph and Telephone Company has been incorporated with a capital stock of $5,000. Daniel Sturgeon is treasurer of the company.

Crescent, S. C.—The Crescent Telephone Company has been incorporated with a capital stock of $700 by S. P. Parks, G. H. Jones and E. Z. Westmoreland.

Nashville, Tenn.—Articles of incorporation have been filed for the Rosemark Telephone Company of Shelby County; capital stock, $2,000. The incorporators are E. A. Thompson, J. T. Gragg, W. R. McCalla, H. T. McQuiston, J. C. Erwin and others.

Henderson, Tenn.—The Home Telephone Company has been organized with the following officers: President, J. E. Johnson; vice-president, J. M. Summers; secretary, Dr. J. H. Stephens; treasurer, T. B. Ellis.

Lone Oak, Tex.—The Lone Oak Rural Telephone Company has been incorporated with a capital stock of $1,600 and will install a telephone exchange at once.

Marlinton, W. Va.—The Mountain View Orchard Company has been incorporated with a capital stock of $75,000 and one of the purposes of the company will be the operation of telephone lines. The incorporators are James Gibson, Yelk; R. A. Stewart, Charleston; A. D. Williams, R. M. Yeager, J. A. Sydenstrickler, Marlinton.

Mineral City, Tex.—The Mineral City Rural Telephone Company has been organized with the following officers; President, William Rommel; vice-president, H. C. Schrock; secretary-treasurer, C. C. Schrock.

Alexandria, Va.—The Richey Telephone Appliance Company has been incorporated with a capital stock of $6,000 and the officers are as follows: President, R. L. Newhouser; vice-president, C. V. Ritchey; secretary and treasurer, D. A. Baer.

Kingston, Wis.—Articles of incorporation have been filed for the Union Telephone Company by E. Dixon, A. O. Ellison and W. O. Bryan.

Kingston, Wis.—The Grand River Telephone Company has been incorporated with a capital stock of $5,000 by H. A. Price, Scott Paterick and Emil Stroschein.

Rockport, W. Va.—Articles of incorporation have been filed for the Citizen's Telephone Company with a capital stock of $5,000. The incorporators are: O. C. Stephens, Slate; A. J. Bowersock, Chas. Ludwig, C. W. Clegg and J. H. Stephens, Rockport; S. A. Reeder and J. S. McWilliams, Mineral Wells.

Rhinelander, Wis.—The Rhinelander Telephone Company has been incorporated by Arthur Taylor, E. O. Brown, C. F. Barnes, E. A. Forbes and D. F. Becker with a capital stock of $25,000.

## *FINANCIAL ITEMS.*

Carlyle, Ill.—The Citizens' Telephone and Telegraph Company has increased its capital stock from $15,000 to $35,000, and the number of its directors from nine to five.

Clear Lake, Ia.—The local telephone company has reincorporated and increased its capital stock from $10,000 to $40,000.

Monroe City, Mo.—The capital stock of the Farmers' and Merchants' Telephone Company has been increased from $6,000 to $10,000.

Aurora, Neb.—The Hamilton County Telephone Company has been granted permission to issue $1,000 worth of stock to build farm lines.

Glenburn, N. D.—The Lone Star Rural Telephone Company has increased its capital stock to $10,000 and will extend its lines.

Windber, Pa.—The Windber Telephone Company has filed an amendment increasing its capital stock from $25,000 to $50,000.

Philadelphia, Pa.—The Interstate Telephone and Telegraph Company has made application to the New Jersey State Utility Commission for permission to issue $1,525,000 mortgage bonds to take up prior bond issues.

Dallas, Tex.—The Dallas Automatic Telephone Company has filed an amendment increasing its capital stock from $500,000 to $700,000.

Mason City, Ia.—The Clear Lake Telephone Company has reincorporated and has increased its capital stock from $10,000 to $40,000.

Battle Ground, Ind.—The Battle Ground Telephone Company has increased its capital stock from $1,500 to $2,000.

Fredonia, Kan.—The name of the Fredonia Co-operative Telephone Company has been changed to the Fredonia Telephone Company and the capital stock has been increased from $4,000 to $24,000.

Richardton, N. D.—The Peoples' Telephone Company has increased its capital stock from $10,000 to $50,000 and has announced plans which call for the completion of a general telephone system covering the entire surrounding district.

Vandergrift, Pa.—The capital stock of the Vandergrift Telephone Company has been increased from $45,000 to $100,000.

Dallas, Tex.—The Dallas Automatic Telephone Company has filed an amendment increasing its capital stock from $500,000 to $700,000.

## *FRANCHISES ASKED AND GRANTED.*

Gentry, Ark.—The Mt. Zion Telephone Company has been granted a ten-year franchise here.

Fulton, Mo.—The Buffum Telephone Company has been granted a new franchise in this city and the company announces it will begin the installation of a new $40,000 plant. J. C. Thornton is manager of the company.

Savanna, Ill.—The Mutual Telephone Company has been granted a franchise by the city council.

Las Cruces, N. M.—The Mountain States Telephone and Telegraph Company has been granted a twenty-five-year franchise in this city. The company will entirely rebuild the old system and install modern improvements and equipment.

SUSANVILLE, CAL.—The Johnstonville Telephone Company has been granted a five-year franchise to install a telephone system in this place.

UNDERWOOD, N. D.—The McLean County Farmers' Telephone Company has been granted a franchise here.

BELFIELD, N. D.—The Belfield and Northwestern Telephone Company has been granted a franchise.

CARLTON, ORE.—The Carlton Mutual Telephone Company has been granted a local franchise.

GRANT'S PASS, ORE.—The Home Telephone Company of Le Grande has applied for a franchise in this place.

ECHO, ORE.—The city council has granted C. P. Bowman a franchise for a telephone line extending from Heppner to Umatilla, connecting Echo, Stanfield and Hermiston, and later, Pendleton.

WILLS POINT, TEX.—The city council has granted the Union Telephone Company a franchise to install a telephone system and an up-to-date system with all modern improvements will be installed.

TEKO, WASH.—The Pacific Telephone and Telegraph Company has applied for a franchise in this place, with the purpose of making extensions and improvements.

COLVILLE, WASH.—The Board of County Commissioners has granted the North Basin Telephone Company a fifty-year franchise to operate a telephone line out of this city.

ODESSA, WASH.—The Pacific Telephone and Telegraph Company has applied for a franchise in this place.

DAYTON, WASH.—The Mt. Vernon Telephone Company has been granted a franchise in this city.

SAVANNA, ILL.—The city council has granted a franchise to the Mutual Telephone Company of this place.

ST. JOSEPH, MO.—The county court has granted a franchise to the Buchanan County Mutual Telephone Company, giving it the right to erect poles and wires on several of the county roads and to maintain a telephone system. The petition was filed by Walter H. Head, secretary. The life of the franchise is twenty-five years.

FULTON, MO.—The city council recently voted to grant a franchise to the Buffum Telephone Company, operating in this city. J. C. Thornton, district manager of the company announced that work on a new $40,000 plant would be started as soon as the franchise is signed by the mayor. The franchise is for 20 years.

LAS CRUCES, N. M.—The Mountain States Telephone and Telegraph Company has been granted a 25-year franchise in this city. It is the purpose of the company to replace the old system with a new common battery system at an estimated cost of $60,000.

KLAMATH FALLS, ORE.—C. C. Chitwood has applied to the county court for permission to erect a telephone line from this city to Upper Swan Lake Valley.

WESTON, ORE.—The council has granted a 25-year franchise to the Pacific Telephone and Telegraph Company for $25 a year. The company expects to rebuild its entire telephone system at this place, at a cost of several thousand dollars, and to install a 100-drop automatic switchboard.

RIDGELAND, S. C.—The Jasper Telephone Company, with headquarters in this place, has been granted permission to erect a telephone exchange. The officers of the company are as follows: President, C. E. Perry, Ridgeland; vice-president, D. O. Fleming, Switzerland; general manager, R. E. Long. Construction will begin at once.

DENISON, TEX.—After nearly two years of wrangling, the city of Denison and the Southwestern Telegraph and Telephone Company have agreed on a franchise and the mayor has issued a proclamation calling for an election accepting or rejecting the same. The life of the franchise is 20 years, and the company agrees to pay a bonus of $500 a year and also a franchise tax. They are to remove all poles to alleys and construct not less than 500 feet of conduits each year in the business district, until all downtown wires are underground.

MCKINNEY, TEX.—The city council has granted a 25-year franchise to the Union Telephone Company to operate a local and long distance telephone system in this place. The company contemplates the expenditure of something like $150,000.

## *RATES.*

BELLINGHAM, WASH.—As the direct result of the increase of rates of the Farmers' Mutual Telephone Company, a new trunk line will be constructed from that city to Sumas, as announced by General Manager Don D. Clark. Previous to the increase the income of the company was not sufficient to permit of any extensive improvements.

HARTSELLE, ALA.—Patrons of the Southern Bell Telephone Company have been notified that the rates on business and residence tlephones will be doubled. There is a general protest among the subscribers who think that a 100 per cent raise is unreasonable and there is a local company being organized for the purpose of installing a local Citizens' Telephone Company.

BIRMINGHAM, ALA.—A petition was recently filed in the Circuit court enjoining the Southern Bell Telephone and Telegraph Company from increasing its telephone rates.

CULMAN, ALA.—The Southern Bell Telephone Company has notified its subscribers that after December 1 the rate will be raised from $1.50 to $2.00 for residence telephones and from $2.00 to $3.00 per month on business telephones. This action is meeting with protest and many have indicated their intention to discontinue the service, especially in the resident portion of the city.

BAY CITY, MICH.—The Bay City board of commerce has declared war upon the Michigan State Telephone Company and is gathering statistics to present to the railway commission in an effort to secure lower telephone rates. With the telephone companies under the Giles law the board believes it can secure a reduction on the ground that Bay City has the highest telephone rates of any city in the state outside of Detroit, with the exception of Saginaw.

CASNOVIA, MICH.—As a result of a raise of $2.00 per telephone by the Michigan State Telephone Company, an independent company, known as the Fruit Belt Line, will soon be in operation in this place.

LOUP CITY, NEB.—The railway commission has given the Sherman County Telephone Company permission to reduce its farm line rates from $15 to $12 a year.

NEW YORK, N. Y.—The reduction in toll rates ordered by the Public Service Commission will take place December 1 and will affect thousands of subscribers in lower Manhattan and in certain sections of the boroughs of Brooklyn and Queens. The reduction is from 10 cents to 5 cents on calls originating at subscribers' telephones, but the present rate will be continued for calls originating at public telephones.

## *MISCELLANEOUS.*

LITTLE ROCK, ARK.—For a consideration of $1,100,000, the Southern Telephone Company has sold its holdings, with the exception of the Little Rock exchange, known as the Little Rock Telephone Company, to the Southwestern Telegraph and Telephone Company. D. A. Gates, of Little Rock; W. J. Savage, of Warren, and Henry Thane, of Arkansas City, were the owners. In addition the Southwestern Company has purchased the North Arkansas Telephone Company with exchanges at Arkadelphia, Malvern, Lohoke, Conway, Morrilton, Searcy, Heber, Leslie and Marshall.

EL CENTRO, CAL.—The Imperial Valley Telephone Company plans for the erection of a new central station in this place. J. F. Bezdecheck is manager of the company.

KISSIMEE, FLA.—The Osceola Telephone Company has elected the following officers for the ensuing year: President, Robert G. Johnston; vice-president, F. W. Hill; secretary and treasurer, A. W. Gustus.

PROHPETSTOWN, ILL.—At the annual meeting of the Farmers' Mutual Telephone Company the following officers were elected: President and manager, M. F. Hill; vice-president, Elwood Beeman; secretary, H. G. Hotchkiss; treasurer, O. P. Betty.

CARLYLE, ILL.—H. J. C. Beckemeyer, ex-representative from this district and owner of practically all of the stock of the Citizens' Telephone and Telegraph Company, has obtained a monopoly of the telephone business in Clinton county by the absorption of the People's Telephone Company, a rival system. The consideration is said to have been $17,000.

PLEASANT VIEW, ILL.—The Pleasant View Telephone Company has elected the following officers: President, Mr. DeNewer; secretary, I. F. Hunt; treasurer, Christian Eneboe.

At the annual meeting of the Noble County Telephone Company the old officers were re-elected as follows: President, M. C. Beck; secretary and treasurer, Thomas M. Reed.

GAS CITY, IND.—The Central Union Telephone Company will spend $40,000 in installing a new cable system in this place and Jonesboro.

BEDFORD, IND.—The 1,200 telephones of the Independent Telephone Company in this city have been connected with the Central Union Company's exchange, making but one exchange in this place.

VINCENNES, IND.—After the first of the year this city will have but one telephone system as the independent plant will

be connected with the Central Union. An independent company, backed by Evansville capital, is said to be ready to ask for a franchise.

COLUMBIA, IND.—The Farmers' Mutual Telephone Company has elected officers as follows: President, Albert Busch; secretary, Joseph Blain; treasurer, W. H. Carter; manager, R. R. Scott.

STACYVILLE, IA.—Peter Halbeck is negotiating for the purchase of the Eureka Telephone Company's exchange at this place.

HENDERSON, IA.—The Wales-Henderson Telephone Company has elected officers as follows: President, Samuel Morgan, Jr.; vice-president, Robert McMullen; secretary, Fred Buehler; treasurer, J. G. Loving.

WICHITA, KAN.—The Kansas Gas and Electric Company has been granted permission to purchase the Newton Telephone Company's system.

PLAINVILLE, KAN.—The Plainville Telephone Company has been purchased by O. T. Kimmel.

LOUISVILLE, KY.—The Home Telephone Company will erect a new western branch exchange on Twenty-sixth street, between Chestnut and Magazine streets, this city, at a cost of $15,000, work to begin the first of the year.

JONESBORO, ARK.—Jonesboro now has but one telephone system, the Home Company having been consolidated with the Southwestern Company.

ARKADELPHIA, ARK.—The owners of the local telephone system are preparing to spend $8,000 or $10,000 in improvements.

RIVERSIDE, CAL.—The Pacific Telephone and Telegraph Company will erect a new business block in this city at a cost of $100,000. J. A. Mathis of Los Angeles has the contract.

ESCONDIDO, CAL.—The Pacific Telephone and Telegraph Company is having plans prepared for a new telephone building at this place to cost $25,000.

WAYCROSS, GA.—It is proposed to make a complete change in the telephone system in this place. A new common battery system will be installed and other improvements which contemplate an expenditure of about $60,000.

DAWSON, GA.—The Cotton Belt Telephone and Telegraph Company has purchased the Blakely Telephone Company's system which includes the systems at Arlington, Kestler, Blakely and Columbia, Ala., and the long distance lines between these points. G. M. Bell of this city is president of the company.

BURLEY, IDAHO.—The Burley Independent Telephone Company has been purchased by the Mountain States Telephone and Telegraph Company which will make a number of improvements and extensions.

NAMPA, IDAHO.—The Mountain States Telephone and Telegraph Company proposes to spend $300,000 within the next year in the improvement of its property in Boise, Ada and Canyon counties.

MACOMB, ILL.—The Macomb Telephone Company, recently incorporated with a capital stock of $50,000, will begin the installation of a telephone system in this city January 1.

ALBION, IND.—At the annual meeting of the Albion Telephone Company Martin C. Beck was re-elected president of the company and Thomas M. Reed secretary and treasurer.

CENTERVILLE, IND.—The Centerville Co-operative Telephone Company has elected the following officers for the ensuing year: President, David Hanigan; vice-president, Frank Clevengerl; secretary, J. E. Burris; treasurer, James Harris; manager, Maniford Richardson.

NEWTON, KAN.—The Home Telephone Company's exchange, owned by the Union Telephone Company of Kansas, has been abandoned, and the business connected with the Missouri-Kansas exchange.

CONCORDIA, KAN.—The United Telephone Company has taken over the exchanges located at Concordia, Abilene, Minneapolis and Beloit, and has also come into possession of the toll lines bought from the Bell Company. The directors of the new company are: A. T. Rogers and W. W. Dilworth of Beloit; C. L. Brown and G. A. Rogers of Abilene, and J. W. Smith of Minneapolis. It is the purpose of the new company to construct new toll lines from Concordia to Atchison and St. Joe.

SILVERDALE, KAN.—A new telephone system will be installed in this place.

BROCKTON, MASS.—The Southern Massachusetts Telephone Company contemplates the expenditure of $80,000 in and around Brockton in the next year on construction work and central office equipment. C. C. Starboard is manager of the local exchange.

LEES SUMMIT, MO.—The Bell telephone exchange in this city has been purchased by William Burkhart, owner of the Home Telephone Company, who proposes to consolidate the exchange with his own. The consideration is said to be $60,000. The Home Company is asking for a new franchise which shall provide for a business rate of $2.50 instead of the present rate of $2.00 and $1.50 for residences in place of $1.00.

SPRINGFIELD, MO.—The Ozark Bell Telephone Company has begun work on improvements to its system in this city which will mean the expenditure of something like a half million dollars.

POLSON, MONT.—It is stated the Northern Idaho and Montana Power Company contemplates extending its power and telephone system from Polson to Ronan at an early date.

MOBERLY, MO.—The magnificent new telephone exchange recently opened by the Moberly Telephone Company has been taken over by the Missouri and Kansas Telephone Company. It will be under the management of E. D. Graham.

APPLETON, CITY, MO.—The Appleton City telephone exchange has been purchased by G. M. Guy. The deal represents a financial consideration of $22,500 and the transfer will take place December 1.

MAYSVILLE, MO.—At a meeting of the stockholders of the De Kalb County Mutual Telephone Company it was decided to sell the property of the company, worth approximately $40,000, at public auction at some date to be agreed upon by the board of directors. The company was formed about ten years ago and owns exchanges in every town in the county and in some of the towns of neighboring counties. It is estimated that the service extends to more than 2,500 residents of the county.

DILLON, MONT.—The offices of the Centennial Telephone Company have been removed to this place. The resignation of Bert Paul, secretary and treasurer, was accepted and he was succeeded by Pearl I. Smith.

FREMONT, NEB.—The Nebraska Telephone Company is preparing to erect a new telephone building in this city at an estimated cost of $60,000 including the building and equipment.

SANTA FE, N. M.—The Santa Fe Telephone Exchange has been purchased by the Mountain States Telephone and Telegraph Company and extensive improvements will be made in the same.

MARYSVILLE, OHIO.—The management of the Union County Telephone Company is making arrangements to install many improvements in the telephone system in this place, which will mean the expenditure of about $15,000. A new switchboard will be installed and the system will be converted into a central energy system. N. E. Liggett is manager of the company.

LORAIN, OHIO.—After several months of negotiations the Amherst Telephone Company has been taken over by Lorain citizens of whom A. V. Hageman is one. The new organization of which A. V. Hageman is president, B. G. Nichols secretary and H. E. Hageman treasurer, will practically reconstruct the entire system and will spend a considerable sum in rebuilding the plant.

ONTARIO, ORE.—The Ontario Independent Telephone Company has been taken over by the Malheur Telephone Company for a consideration of $15,000.

PHILADELPHIA, PA.—The Bell Telephone Company of Pennsylvania has appropriated nearly $50,000 for improvements in this city and vicinity.

AMARILLO, TEX.—A deal has been consumated whereby A. L. Waterbury and associates have taken over the properties of the Panhandle Telegraph and Telephone Company in this city for a consideration of $172,500.

BERCLAIR, TEX.—The local telephone exchange has been purchased by Prof. Cameron and Horace Greathouse has been installed as manager.

SUFFOLK, VA.—The Southern Bell Telephone Company has taken over the holdings of the Atlantic Coast Company.

KEMMERER, WYO.—The Mountain States Telephone and Telegraph Company wil take over the line of the Kemmerer-Pinedale Telephone Company and will spend in the neighborhood of $10,000 in rebuilding the same.

OWENSBORO, KY.—Russell and Brewster, of Chicago, has purchased the controlling interest in the Rural Home Telephone Company in Daviess, McLean, Hancock and Ohio counties and at a meeting of the stockholders it was announced that several thousand dollars would be spent in improving the property. The following officers were elected: President, Theodore Tyler, Chicago; vice-president, W. B. McIllvaine, Chicago; secretary and treasurer, L. N. Birk, Ownesboro.

SHREVEPORT, LA.—The Cumberland Telephone and Telegraph Company will place its wires under ground.